National Park Service
U.S. Department of the Interior

Gateway National Recreation Area - Jamaica Bay Unit
New York

# Gateway National Recreation Area, Jamaica Bay Unit
## *Jamaica Bay Greenway Missing Links Study*


PMIS No. 135878A
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John A. Volpe National Transportation Systems Center

U.S. Department of Transportation
Research and Innovative Technology Administration

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## Report notes

This report was prepared by the U.S. Department of Transportation John A. Volpe National Transportation Systems Center in Cambridge, Massachusetts. The project team was led by David Spiller, and included Charlotte Burger and Michael Kay, of the Systems Operations and Assessment Division.

This effort was undertaken in fulfillment of PMIS 135878A, *Planning to Complete the Missing Link in the Rockaway Gateway Greenway*. The project statement of work was included in the July 2009 modification (no. 2) to the interagency agreement between the National Park Service and the Volpe Center (NPS agreement F4505-08-7777).

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## Acronyms

| | |
|---|---|
| AASHTO | American Association of State Highway Transportation Officials |
| A/E | Architecture/Engineering Contractor |
| ATPPL | Alternative Transportation in Parks and Public Lands Program |
| BCD | Beach Channel Drive |
| CB | Community Board |
| CMAQ | Congestion Mitigation and Air Quality Improvement Program |
| DOI | Department of Interior |
| DOT | Department of Transportation |
| EPA | U.S. Environmental Protection Agency |
| FHWA | Federal Highway Administration |
| FLH | Federal Highway Administration Office of Federal Lands Highway |
| FLHP | Federal Lands Highway Program |
| FTA | Federal Transit Administration |
| GATE | National Park Service Gateway National Recreation Area |
| GMP | General Management Plan |
| JBG | Jamaica Bay Greenway |
| JBU | Jamaica Bay Unit |
| LOS | Level-of-service |
| MPH | Miles per Hour |
| MSA | Metropolitan Statistical Area |
| MTA | Metropolitan Transportation Authority |
| MUTCD | Manual on Uniform Traffic Control Devices |
| NPS | National Park Service |
| NRA | National Recreation Area |
| NYCDCP | New York City Department of City Planning |
| NYCDOT | New York City Department of Transportation |
| NYC Parks | New York City Parks Department |
| PMIS | National Park Service Project Management Information System |
| PRP | National Park Service Park Roads and Parkways Program |
| ROW | Right-of-way |
| RPA | Regional Plan Association |
| RTCA | National Park Service Rivers, Trails, and Conservation Assistance Program |
| TAC | Technical Advisory Committee |
| TRIP | Paul S. Sarbanes Transit in Parks Program |
| USACE | U.S. Army Corps of Engineers |

## Executive summary

Based on field site reconnaissance and workshops, this study develops a conceptual plan for the location and design of bicycle and pedestrian facilities to complete a "missing link" of the Jamaica Bay Greenway in and around the National Park Service Gateway National Recreation Area – Jamaica Bay Unit in New York City. The study focuses on non-motorized infrastructure, as well as signage and wayfinding, to enhance connections for visitors between Jamaica Bay Unit sites and centers of transportation. Both near term and long term interventions are considered.

*Transportation network overview*

Research confirmed a number of issues with the existing road infrastructure affecting both access and safety for pedestrians and bicyclists. These include:

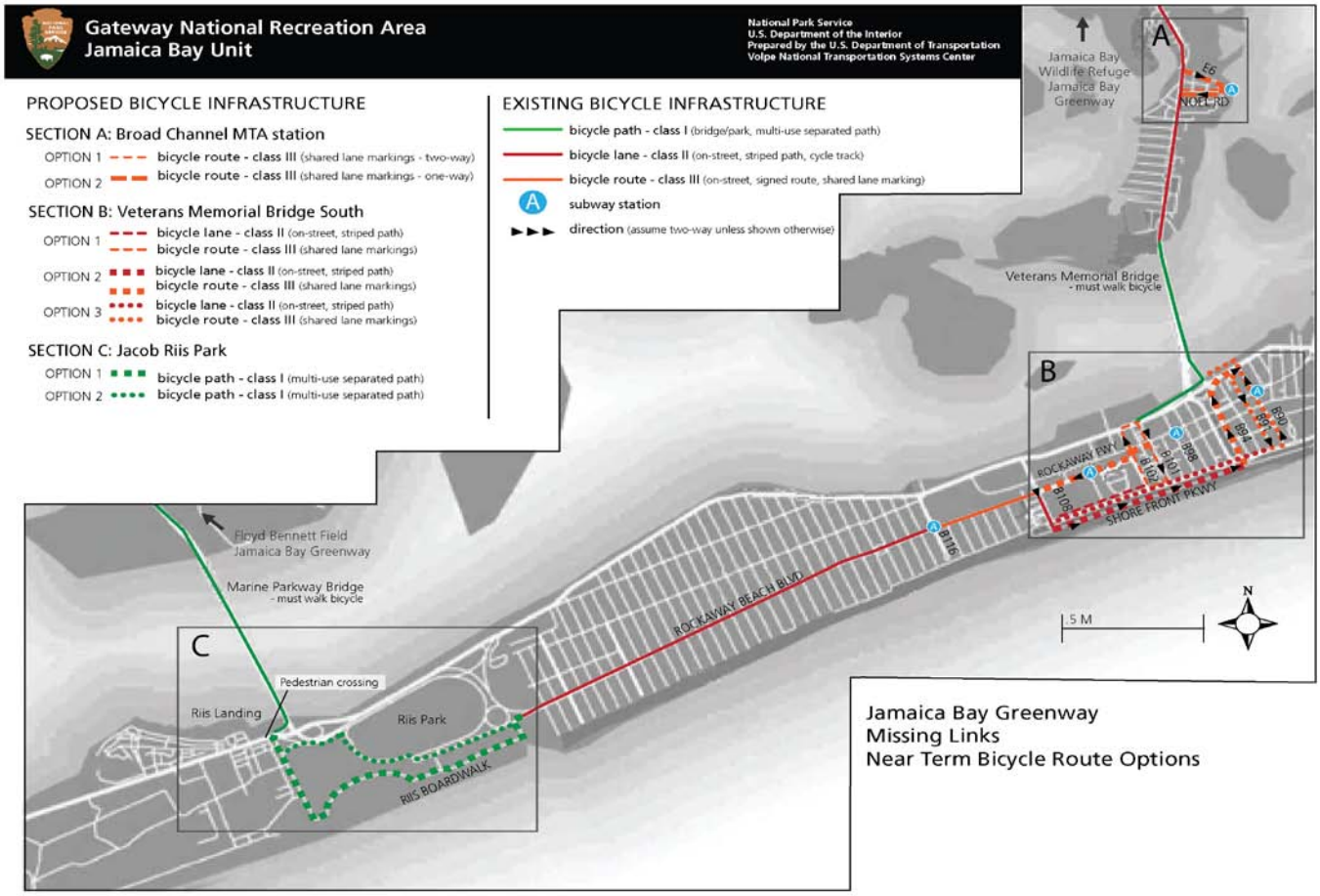
- High volume, high speed arterials with commercial traffic and conflicting turning movements;
- Complex traffic weaving/merging;
- Lack of signage and wayfinding to key destinations;
- Lack of north/south connector roads accommodating to bicyclists and pedestrians; and
- One-way street patterns that make travel by bicycles circuitous and non-intuitive.

*Near term interventions*

The majority of near term treatments involve the provision of roadway markings (i.e. bicycle lanes or shared lane markings) and signage. Treatments would not remove parking and do not require significant construction. The near term interventions seek to achieve the goals of the study relatively quickly, at minimal cost and with minimal disruption to traffic and to local residents.

Figure ES-1 illustrates the near term route options identified in the study.

**Figure ES-1**
**Near term bicycle route/intervention options**
Source: U.S. DOT, Volpe Center

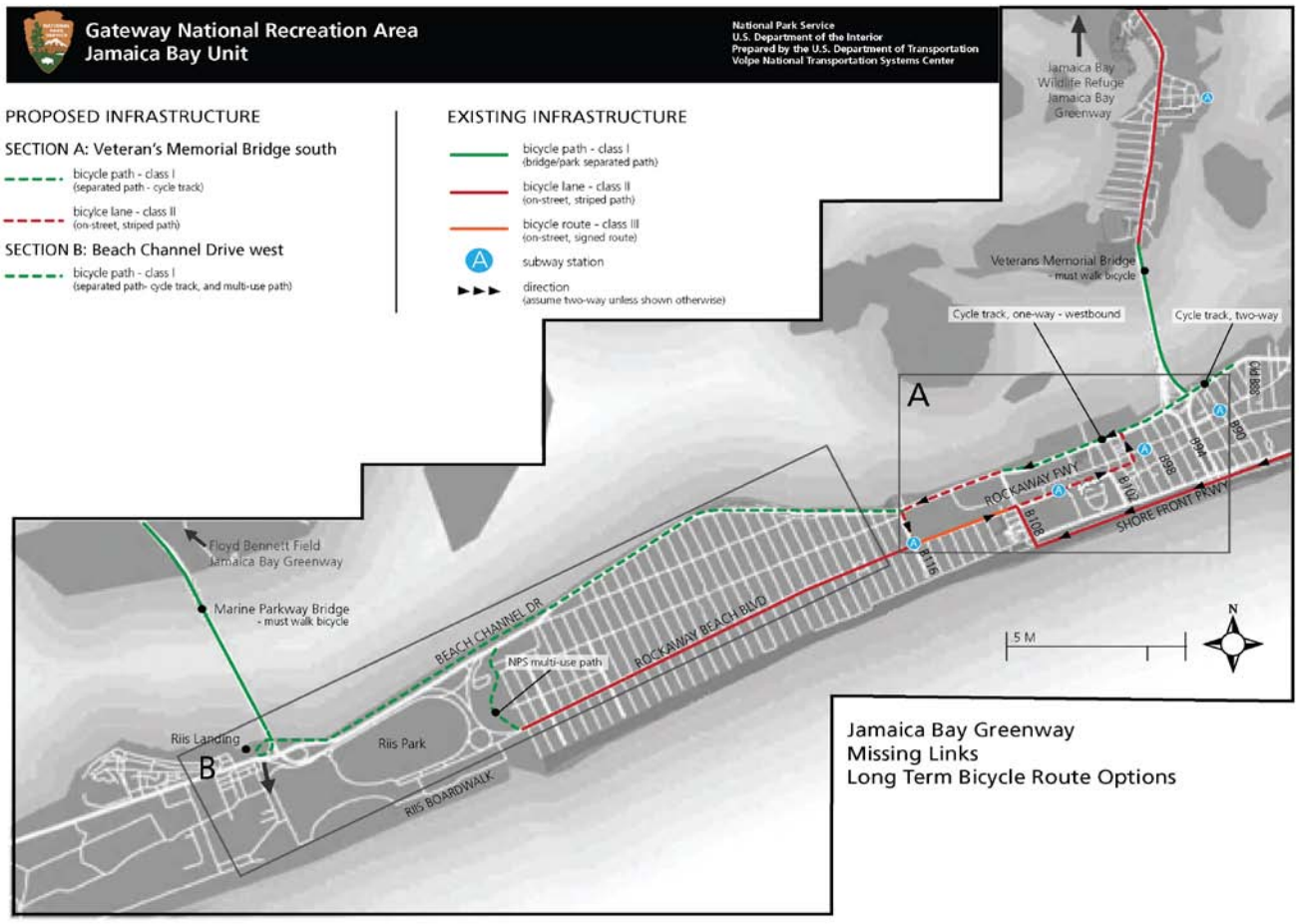



*Long term interventions*

The long term visions call for a reconfiguration of one of the main arterials through the study area, Beach Channel Drive. This heavily travelled road adjacent to Jamaica Bay has pockets with no shorefront development, and other sections with commercial, industrial, and municipal development. A redesign of Beach Channel Drive would change its character into an "urban boulevard", incorporating environmentally friendly features and providing for a safe, direct, and visually appealing route along Jamaica Bay for both pedestrians and bicyclists.

Figure ES-2 illustrates the components of the long term vision for Beach Channel Drive and the surrounding area.

**Figure ES-2**
**Long term bicycle route/intervention options**
Source: U.S. DOT, Volpe Center




*Next steps*

The final section provides a series of next steps that the National Park Service can undertake independently, and in partnership with identified city agencies and local stakeholders, to chart a course of action forward to advance the goals of the study.

## Section 1: Study purpose

Established in 1972, the National Park Service (NPS) Gateway National Recreation Area (NRA) comprises three park units: Jamaica Bay (Brooklyn and Queens, New York), Staten Island (New York), and Sandy Hook (New Jersey). Gateway covers approximately 26,000 acres of ocean beaches, maritime forests, freshwater ponds, and salt marshes entirely within the New York metropolitan region. These natural resources offer an array of environments for wildlife, including 300 species of birds that migrate to the area during the spring and fall seasons. Gateway also provides residents of the surrounding urban areas with recreational, educational, and cultural opportunities. Gateway receives roughly 9 million visitors a year, in part due to its proximity to large urban populations in New York, New Jersey, and Connecticut. Figure 1 illustrates the three units of Gateway NRA.

**Figure 1 - Gateway National Recreation Area**
Source: NPS


The Jamaica Bay Unit (JBU) of the Gateway NRA, located at the southern end of the boroughs of Brooklyn and Queens, welcomes approximately 3.5 million[1] visitors to the area during the peak season from May through September. Major destination sites within the Jamaica Bay Unit include the Jamaica Bay Wildlife Refuge ("the Refuge"), Jacob Riis Park, Fort Tilden, and Floyd Bennett Field. Existing transit penetration and limited bicycle infrastructure in the Jamaica Bay area allow for multimodal connections, encouraging visitation to Jamaica Bay Unit sites without the use of an automobile.

[1] NPS Public Use Statistics Office. http://www.nature.nps.gov/stats/ Accessed March 25, 2010.

In 2008, NPS received a grant through the Alternative Transportation in Parks and Public Lands Program (ATPPL) Program to conduct a planning study addressing the missing gaps in the existing Jamaica Bay Greenway (JBG). The ATPPL (now Paul S. Sarbanes Transit in Parks, or TRIP) Program is administered by the Federal Transit Administration (FTA), in partnership with the U.S. Department of Interior (DOI).

In fulfillment of this study, this report contains guidance provided by the U.S. DOT Volpe National Transportation Systems Center (Volpe Center) to the JBU in the planning and conceptual development of a safe, non-motorized network to complete the JBG.

The options outlined in this report do not provide a sufficient level of analysis to allow for immediate construction of these facilities. This study documents general characteristics of locations, the qualitative perception of traversing the roadways, and the overall extent of improvements that could enhance select roadways. This report is generated as a means to inform NPS staff and local regulating and planning agencies about these field conditions and the potential for area enhancements.

The purpose of this study is to:

- Provide conceptual planning for potential bicycle routes along a missing portion of the JBG;
- Improve connections between NPS sites and transit stations in the Broad Channel and Rockaway neighborhoods; and
- Identify pedestrian and bicycle wayfinding needs at key locations.

The study also provides an opportunity to foster innovative partnerships among staff at the JBU, local city agencies, and neighborhood advocacy groups to improve non-motorized travel networks in the gateway communities surrounding NPS sites in the JBU, and the JBG.

Several stakeholder groups, including the Regional Plan Association (RPA), New York City Department of Transportation (NYCDOT), the New York City Department of City Planning (NYCDCP), and the New York City Parks Department (NYC Parks) were consulted during the course of this study.

## Section 2: Study methodology and report organization

### 2.1 Site visit and stakeholder meetings

The study team conducted a two-day field audit of the study area to examine the physical environment, barriers to access or mobility, and safety concerns. From these observations, the study sought to define bicycle facilities where none existed in order to connect to existing bicycle facilities, area Metropolitan Transit Authority (MTA) stations, and NPS destinations within Jamaica Bay, while mitigating risks to bicyclists and pedestrians, thus effectively increasing the overall access to these areas.

The study team also conducted two stakeholder meetings in New York. The first meeting was for area planning agencies and non-profit organizations with an interest in the JBG, as identified by NPS staff. Attendees included:

- NPS Jamaica Bay Unit staff;
- NPS Rivers, Trails, and Conservation Assistance (RTCA) Program staff;
- Regional Plan Association (RPA); and
- Brooklyn Greenway Initiative.

The purpose of the meeting was to introduce the study, discuss the NPS vision for the creation of a continuous greenway around Jamaica Bay, consider current projects and plans, and solicit ideas and support for creating a continuous greenway around Jamaica Bay by identifying the missing links and potential connections within these stakeholder communities. Transportation Alternatives was not able to attend, but indicated support for the project and a desire to stay informed of its progress.

The second stakeholder meeting was a workshop with local New York City agencies, attended by:

- NPS Jamaica Bay Unit staff;
- NPS Rivers, Trails, and Conservation Assistance (RTCA) Program staff;
- New York City Department of Transportation (NYCDOT);
- New York City Department of City Planning (NYCDCP); and
- New York City Parks Department (NYC Parks).

This workshop with the agencies responsible for planning and implementation provided an opportunity to discuss:

- Options for completing the missing links in the JBG
- Potential for partnerships
- Process and decision-making considerations for implementing bicycle and pedestrian improvements
- Broad cost estimates related to the interventions and improvements considered in this report

The options identified in this report were developed with guidance and support obtained at these meetings, and offer new concepts to complement the recommendations contained in the 2009 NYCDCP Woodhaven study (described in Section 3.6) and other planning efforts in the Jamaica Bay area.

## 2.2 Report organization

The report is organized into twelve main sections.

Section One introduces the project purpose and background on the history of the Gateway National Recreation Area and the Jamaica Bay Greenway.

Section Two describes the study methodology and report organization.

Section Three provides an analysis of the major characteristics of the Jamaica Bay Unit, including visitation, area population, bicycle infrastructure, transit, bicycle and pedestrian planning studies, motorized planning studies, and partnerships. This section also outlines the study area.

Section Four describes the conditions of the existing transportation network, focusing primarily on the conditions for bicycling and walking, highlighting safety concerns and the feasibility of improving the physical environment for these users.

Section Five provides an introduction to the near term and long term intervention options, including bicycle and pedestrian route selection criteria, how to use the information, and limitations and general notes.

Section Six outlines the near term intervention options for the creation of potential bicycle routes through the study area that connect Jamaica Bay Unit sites. Near term interventions are those elements that are physically feasible using the existing roadway network and surrounding infrastructure, require little to no construction, and could be completed within several years.

Sections Seven, Eight, and Nine describe the pedestrian, transit station, and wayfinding infrastructure in the study area, as these issues contribute to a holistic approach to filling the missing link in the JBG.

Section Ten describes the long term planning vision for Beach Channel Drive, which includes a full-scale transformation of bicycle infrastructure, streetscape, area water quality, and mobility along this portion of road between the Veterans Memorial Bridge and the Marine Parkway Bridge. Long term interventions are those that require significant planning, construction, and cost.

Section Eleven outlines the potential funding sources available to NPS and its area stakeholders for planning and implementation of the options presented in this report.

Section Twelve outlines the next steps that NPS can take alone, or in partnership with area stakeholders to improve bicycling and pedestrian conditions in the study area, and to complete the missing link of the JBG.

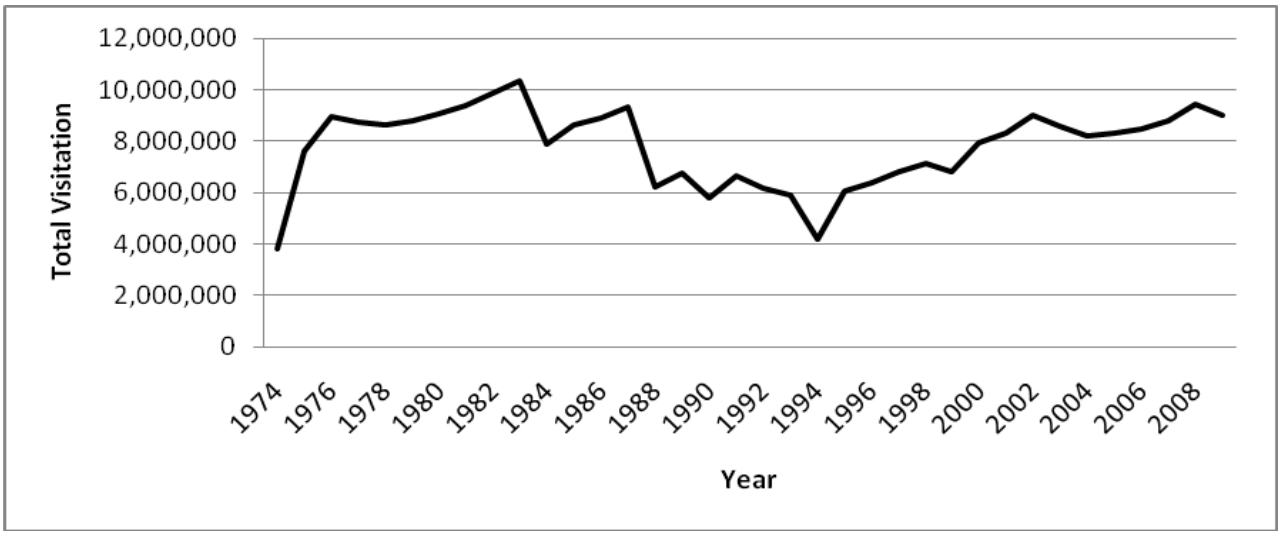
## Section 3: NPS Gateway National Recreation Area - Jamaica Bay Unit

The Jamaica Bay Unit has a wealth of history, nature and recreation, from New York City's first major airport and coastal fortifications to a wildlife refuge and pristine beaches. This section describes the study area, as well as the key characteristics, statistics, and research that guided the study team.

### 3.1 Visitation

Figure 2 illustrates annual recreational visitation to all units within the Gateway NRA since 1974. Since the mid-1990s, overall visitation has more than doubled to over 9 million in 2009.

**Figure 2 - Gateway NRA visitation, 1974-2009**
Source: NPS Public Use Statistics




The Jamaica Bay Unit of Gateway NRA comprises approximately 32 square miles and more than 19,000 acres, making Jamaica Bay the "largest natural open space in New York City[2]." In 2009, the Jamaica Bay Unit received about 4.4 million visitors[3]. Many visitors to the area come from the surrounding boroughs of Brooklyn and Queens, other parts of New York City, New Jersey, and the United States[4]. According to a 2003 visitor study of Floyd Bennett Field, over half (53 percent) of visitors come to the area more than once a week, which may indicate that these visitors live in proximate neighborhoods[5].

[2] New York Facts: Saving Jamaica Bay. June 2007 © Natural Resources Defense Council, www.nrdc.org/policy. Accessed March 25, 2010.
[3] NPS Public Use Statistics Office. http://www.nature.nps.gov/stats/viewReport.cfm. Accessed March 25, 2010.
[4] Visitor Services Project Gateway National Recreation Area - Floyd Bennett Field Report Summary.
[5] Visitor Services Project Gateway National Recreation Area - Floyd Bennett Field Report Summary. 2003.

Figure 3 illustrates the key attractions at Jamaica Bay, where visitation is tracked through both automated and manual counts.

**Figure 3 - Jamaica Bay Unit attractions**
Source: NPS


**Floyd Bennett Field** is located on the northwest side of the Jamaica Bay Unit off of the Marine Parkway Bridge. Floyd Bennett Field is the site of New York City's first municipal airport, officially opened in 1931, and later became a significant airfield in World War II. NPS has preserved Floyd Bennett to provide visitors with educational, recreational, historical, and cultural opportunities. NPS maintains several historic buildings and hangars at the site, including a collection of vintage aircraft that provides a historical context for the past operations of the airfield. In 2006, four of the eight original airport hangars on the site were adapted into a community-based sports and entertainment complex, including a concessionaire that provides on-site bicycle and helmet rentals. Activities at the site include hiking, walking, golfing, flying model airplanes, land sailing, bird watching, a youth camping program focused on environmental education, and bicycling on the old runways[6].

**Jacob Riis Park** was initially established in 1912, but soon became the United States Naval Air Station at Rockaway, which remained on the site for over a decade. When the Navy left the area in 1928, it was redeveloped into a seaside recreation park by Robert Moses, the New York Parks Commissioner at the time. The park includes seasonal food concessionaires, a public beach and a boardwalk shown in Figure 4

[6] NPS. http://www.nps.gov/gate/historyculture/floyd-bennett-field.htm. Accessed March 23, 2010.

that connects historic bathhouses, a walking mall, basketball and tennis courts, and other open spaces with expansive views of the Atlantic Ocean to the south and New York City to the north[7].

**Figure 4 - Jacob Riis Park boardwalk**
Source: NPS

**Jamaica Bay Wildlife Refuge** is centrally located within the Jamaica Bay Unit, with the visitor center accessible from Cross Bay Boulevard. Activities at the refuge include bird watching, walking and hiking, and attending educational programming, tours, and lectures at the visitor center.

**Fort Tilden** is located between Jacob Riis Park in the east and the Breezy Point residential area. The site contains mostly natural areas and open space, consisting of maritime forests, beaches, and dunes, but also includes abandoned military installations and historical structures, some of which have become area art centers.

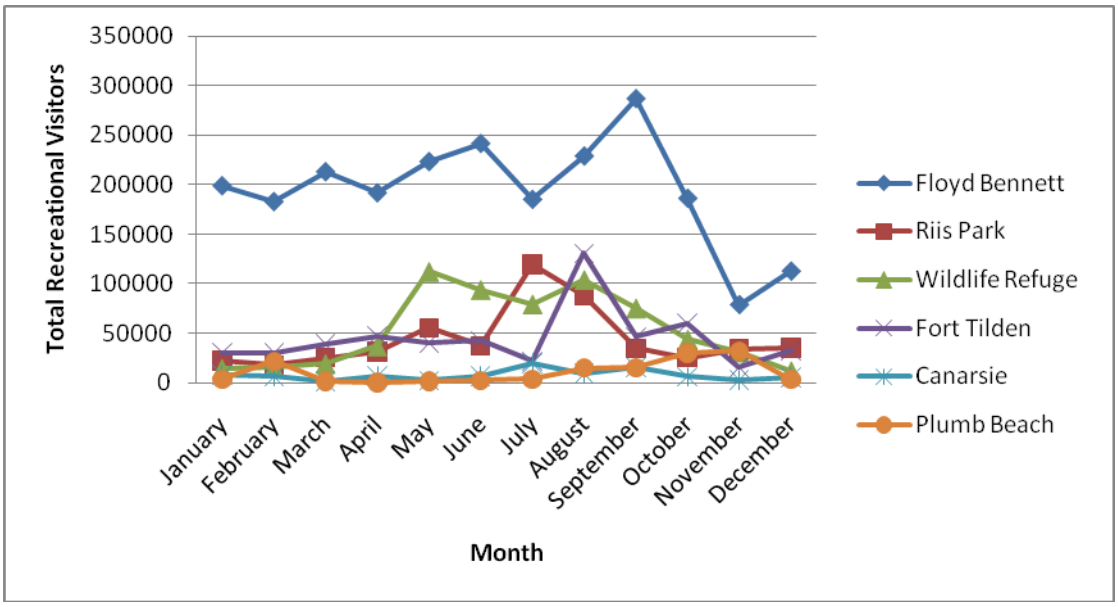
**Canarsie Pier,** located on the north side of Jamaica Bay, is a popular fishing location for the surrounding community and includes a picnic area along Jamaica Bay[8].

**Plumb Beach** is located on the western end of Jamaica Bay, accessible by the Belt Parkway. The area is a popular location for windsurfing and kitesurfing.

Figure 5 illustrates the seasonal visitation of key sites in Jamaica Bay for 2009. Floyd Bennett Field attracts the greatest amount of year-round visitation, peaking in June and again in September, and falling through the colder months. Jacob Riis Park, the Jamaica Bay Wildlife Refuge, and Fort Tilden experience the next highest levels of visitation with various peaks throughout the months of May, July, and August.

[7] NPS. http://www.nps.gov/gate/historyculture/jamaica-bay-unit-places.htm. Accessed March 23, 2010.
[8] NY Harbor Parks. http://www.nyharborparks.org/visit/capi.html. Accessed March 23, 2010.

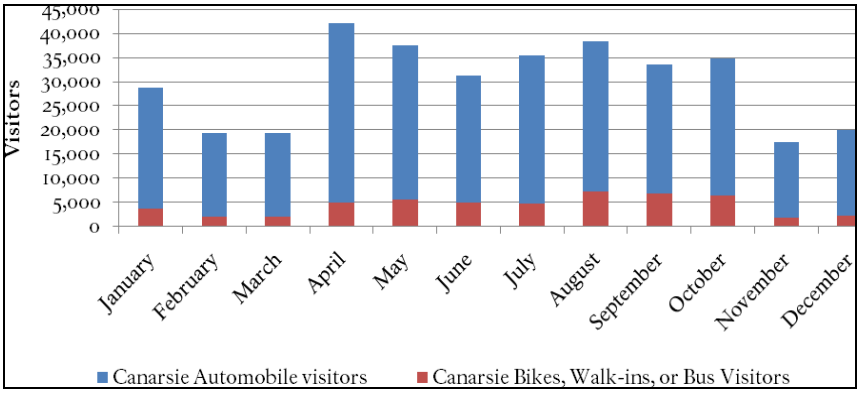
**Figure 5 - Jamaica Bay Unit visitation, 2009**
Source: NPS Public Use Statistics

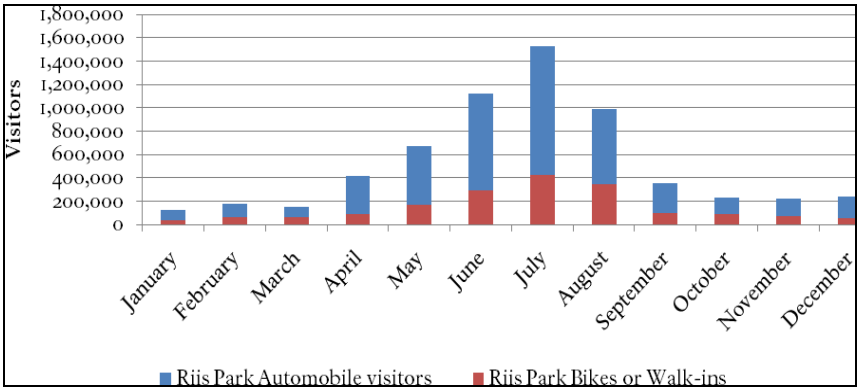


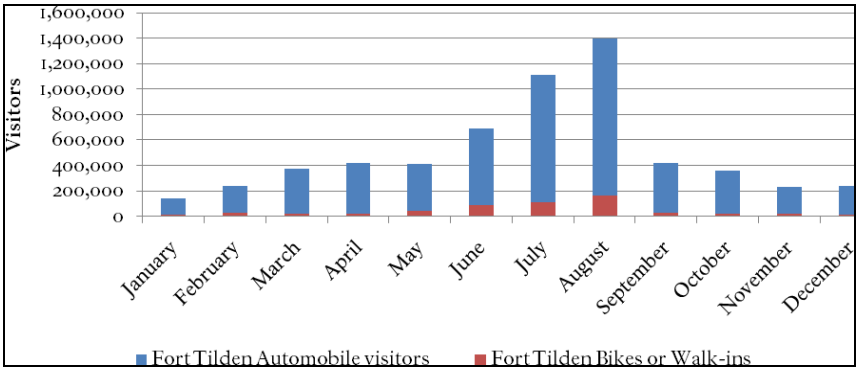

NPS collects data on visitor modes of access at select locations throughout the Jamaica Bay Unit. Automobiles are counted automatically by an inductive loop detector placed at entrances. Bicycle, walk-in, and bus visits (only at Canarsie Pier) are counted manually by NPS staff[9]. Figure 6 illustrates the monthly number of visitors to various Jamaica Bay Unit sites by mode for 2009. In July, for example, roughly 25 percent of visitors to Jacob Riis Park arrived by a mode other than an automobile, and at Canarsie Pier that number was nearly 15 percent. The other sites have far less walk-in or bicycle visitation, though improvements to access and wayfinding along the approaches to these areas may help to increase the non-auto mode share to these sites.

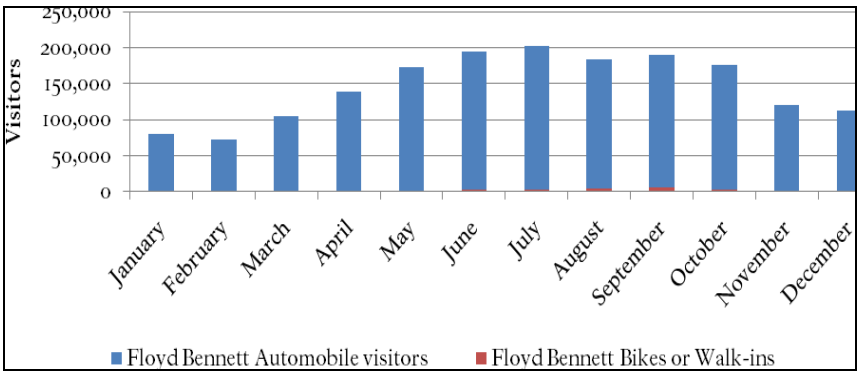
[9] NPS Public Use Statistics Office. http://www.nature.nps.gov/stats/ Accessed March 29, 2010.

**Figure 6 - Jamaica Bay Unit visitation by mode, 2009**
Source: NPS Public Use Statistics



### 3.2 Population

Jamaica Bay is surrounded by a highly dense urban population. The *New York-Northern New Jersey-Long Island, New York-New Jersey-Pennsylvania* Metropolitan Statistical Area (MSA) has a population of 19 million people, 8.3 million of whom live in New York City [10]. New York City is divided into community boards that advise government agencies to address neighborhood needs. There are over 600,000 residents located in the areas represented by the four community boards adjacent to Jamaica Bay. From 1990 to 2000, local population increased collectively by 13 percent. From 2000-2008, the U.S. Census estimates a population increase of 3.7 percent in Brooklyn, 2.9 percent in Queens, and 4.4 percent in all of New York City [11].

Table 1 illustrates the population changes in the surrounding neighborhoods of the Jamaica Bay Unit from 1990-2000.

**Table 1 - Jamaica Bay Unit area population**
Source: NYCDCP

| Community Board (CB) | 1990 Population | 2000 Population | Percent Change |
|---|---|---|---|
| Queens CB 14 | 100,596 | 106,686 | 6.1 percent |
| Queens CB 10 | 107,768 | 127,274 | 18.1 percent |
| Brooklyn CB 5 | 161,350 | 173,198 | 7.3 percent |
| Brooklyn CB 18 | 162,428 | 194,653 | 19.8 percent |

### 3.3 Study area

Figure 7 illustrates the Jamaica Bay Greenway Missing Links study area bounded in yellow, which approximately encompasses the Broad Channel and Rockaways neighborhoods. The Gateway NRA boundary is shown in blue, and the existing JBG is shown in green.

[10] New York City Department of City Planning. http://www.nyc.gov/html/dcp/html/census/popcur.shtml. Accessed April 2, 2010.
[11] New York City Department of City Planning. http://www.nyc.gov/html/dcp/html/census/popcur.shtml. Accessed April 2, 2010.

**Figure 7 - Study area**
Sources: NPS, U.S. DOT, Volpe Center


In the Broad Channel neighborhood the study area is bounded between the entrance to the Jamaica Bay Wildlife Refuge and the approach to the Veterans Memorial Bridge. Field observations focused on the streets adjacent to the Metropolitan Transportation Authority (MTA) Broad Channel station and Cross Bay Boulevard.

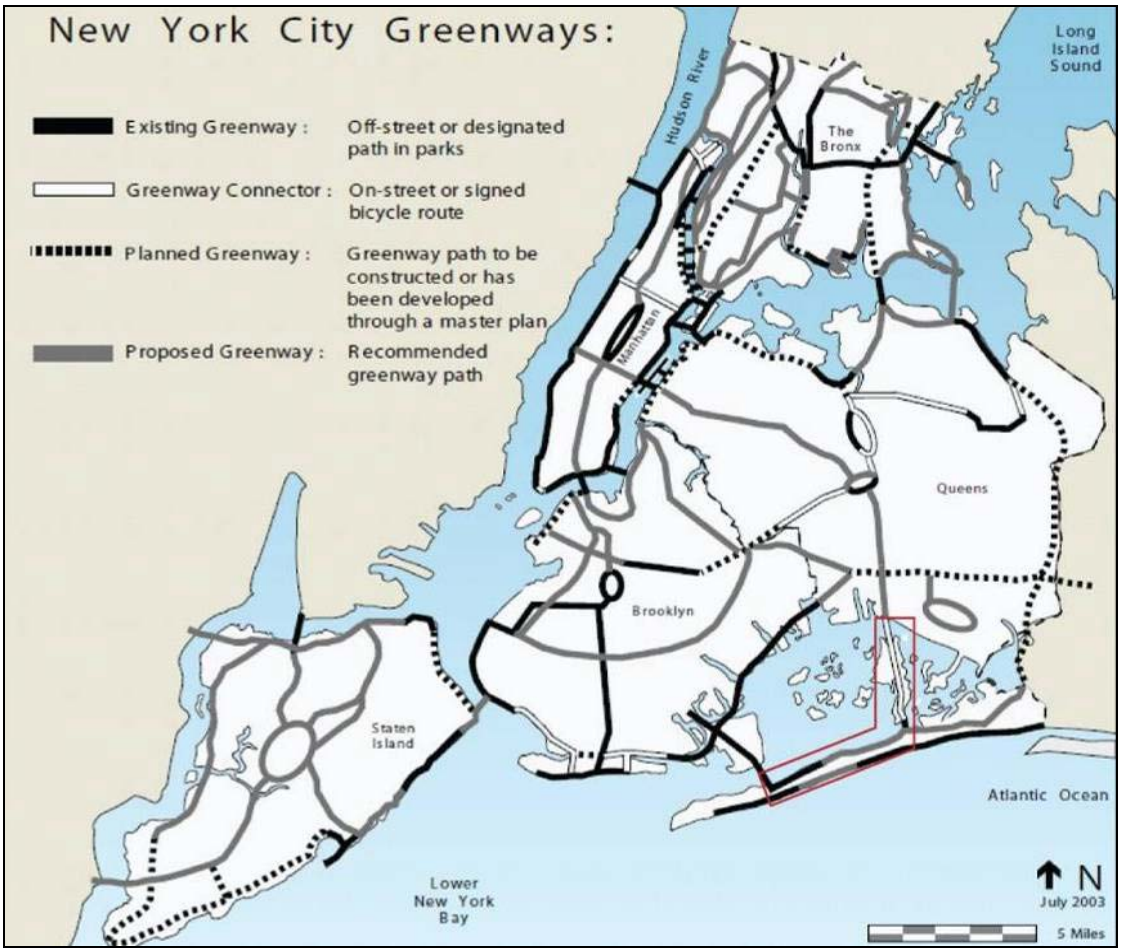
In the Rockaways, the study area is bounded by the Veterans Memorial Bridge in the east and the Marine Parkway Bridge in the west, as well as the adjacent approaches. Field observations focused on the streets that surround and provide access to the MTA Rockaway Park-Beach 116th Street station, and major arterial connections to Jacob Riis Park, Riis Landing, and the Marine Parkway Bridge leading to Floyd Bennett Field.

### 3.4 Jamaica Bay Greenway

Currently, 16 miles of the proposed 26-mile JBG are complete, created in partnership with multiple public agencies at the city and state levels. Much of the existing route runs along the northern shores of Jamaica Bay and connects to the Jamaica Bay Wildlife Refuge. The Greenway also travels south over the Marine Parkway Bridge to Fort Tilden and Riis Park. The JBG is a car-free path where bicyclists, skaters, joggers, and others do not have to contend with roadway traffic. The Greenway serves as both a space to recreate and as a bicycle commute path for local residents.

Figure 8 illustrates the New York City Greenway System Plan (July 2003) for existing, planned, and proposed on- and off-street paths and connectors. The red shape highlights the study area for this project. The links designated as "proposed" facilities on the plan correspond with current missing links in the Greenway.

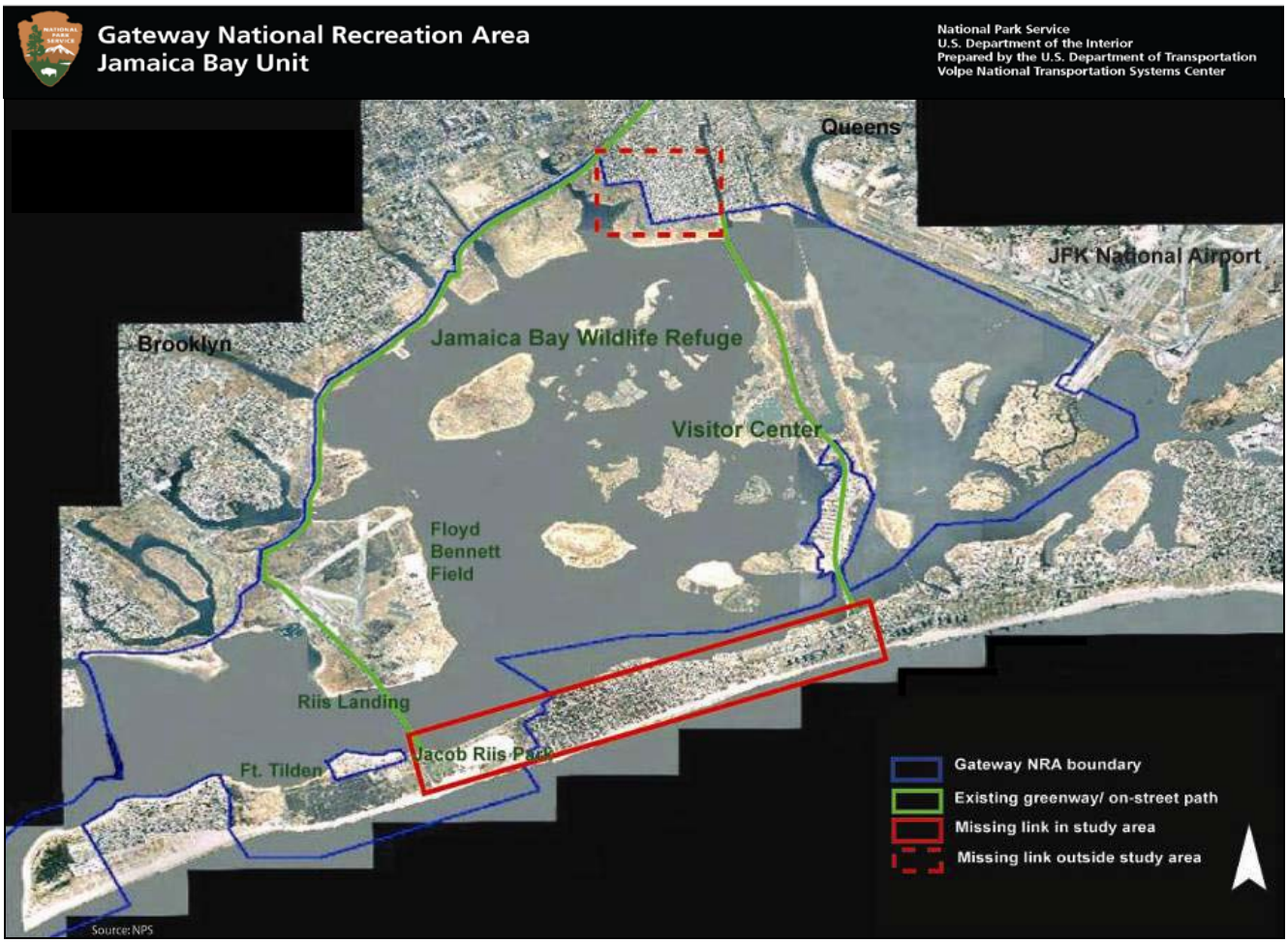
**Figure 8 - New York City Greenways**
Source: NYCDCP




NPS has a strong interest in completing the Greenway to improve connections to its Jamaica Bay sites and the overall visitor experience. NPS is sensitive to the issues that arise for gateway communities around Jamaica Bay, and makes an effort to reduce vehicular traffic in local communities, reduce parking demand at NPS sites, and promote safe and sustainable multimodal transportation to NPS sites for pedestrians, bicyclists, and transit users.

Figure 9 further illustrates identified "missing links" in the JBG. The solid red box denotes a missing link within the study area. The dashed red box denotes a missing link in the Howard Beach area of Jamaica Bay, located outside of the study area.

**Figure 9 - Jamaica Bay Greenway missing links**
Sources: NPS, U.S. DOT, Volpe Center

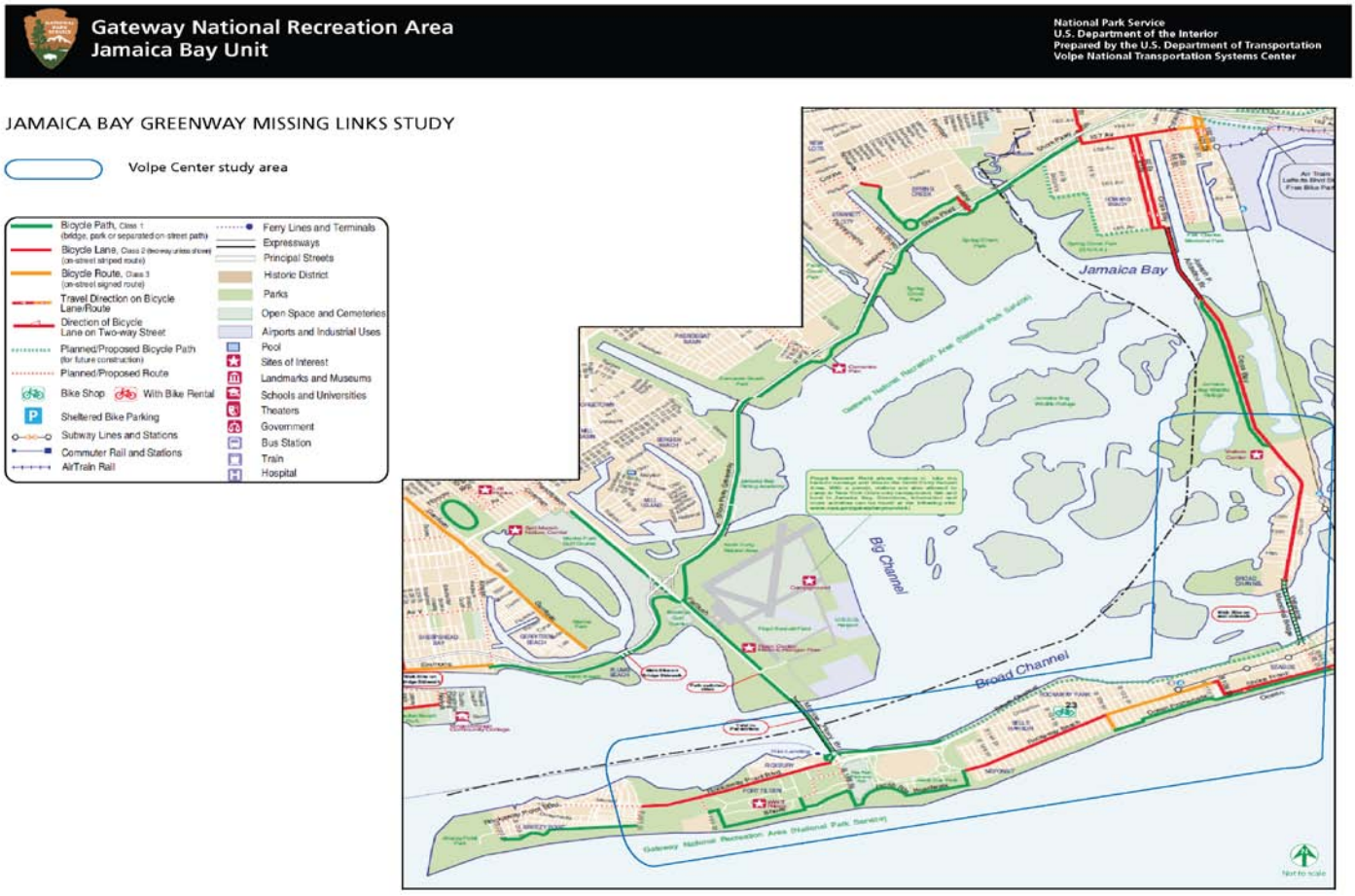


### 3.5 Bicycle infrastructure

Existing bicycle infrastructure in the study area includes the JBG and several city-maintained Class I bicycle paths (bridge, park, or separated on-street path), Class II bicycle lanes (on-street striped lanes), and Class III bicycle routes (on-street signed route facilities). See Appendix E for more information on bicycle facility types.

Figure 10 illustrates the existing NYCDOT bicycle facilities in the study area region, where red denotes on-street striped bicycle lanes, green denotes separated off-street paths, and orange denotes a signed bicycle route.

**Figure 10 - NYC Bicycle Map 2010; study area outlined**
Source: NYCDOT, U.S. DOT, Volpe Center




Through the northern section of Jamaica Bay, considerable bicycle infrastructure exists along the JBG to connect the various NPS sites, including Floyd Bennett Field, Canarsie Pier, and the Jamaica Bay Wildlife Refuge. Bicycle infrastructure through the southern portion of Jamaica Bay is limited and discontinuous.

## Bicycling in New York City

The cycling culture in New York City is well established. The city's density, population, and potential for traffic congestion combine to make cycling convenient for commuting, service deliveries, a general means of travel for running errands or visiting friends, and for recreation.

There are a number of programs, supported by various city agencies that actively promote cycling; including the city's sweeping planning effort, PLANYC. For example, NYCDCP promotes cycling in city parks including Central Park and Prospect Park by restricting vehicle access to these areas during specific weekday hours, and during the entire weekend. For the third year in a row, NYCDOT has sponsored "Summer Streets" that closes Park Avenue and the connecting streets from the Brooklyn Bridge to Central Park to motor vehicles and opens it for people to walk, run, and bike the areas. Furthermore, the city's bike network of on-street, and physically separated cycle tracks (see Section 10) has grown to over 150 miles of painted bicycle lanes, and is expanding. The city intends to "double bicycle commuting over 2007 levels by 2012 and triple it by 2017," and believes that facilities like bicycle lanes, and bicycle parking will support these goals.

According to the report Bike Share Opportunities in New York, (NYCDCP, 2009) bicyclists make up 0.6 percent of all commuters in New York City. This is significantly higher than San Francisco, even with its higher overall bicycle mode-split. New York City's extensive subway system allows bicycles at all hours, and although crowding can make bringing a bicycle on board challenging, the policy creates the opportunity for mixed-mode trips to popular destinations. Figure 11 demonstrates the popularity of the NYC Five Boro Bike Tour, and also illustrates the city's commitment to promoting bicycling with the installation of new state of the art covered bicycle parking.

**Figure 11 - NYC Five Boro Bike Tour (left), NYC bicycle parking (right)**
Source: Roadbikereview.com (left) and NYCDOT (right)

### 3.6 Transit

Table 2 and Figure 12 illustrate transit penetration in the area. Subway access to Jamaica Bay is most direct on the MTA "A" line, as well as the "L," "2," and "5" lines. There is also a Shuttle ("S") connection between the Rockaways and the main branch of the "A" line at Broad Channel. See Appendix A for service frequencies of MTA subways and bus lines through the area.

**Table 2 - Bus and subway lines and service area in study area region**
Source: MTA

| | Line | Service area |
|---|---|---|
| Bus | Q35 | Brooklyn-Rockaway Park (via Flatbush Ave.) |
| | Q21 | Elmhurst-Broad Channel-Rockaway Park |
| | Q22 | Rockaways (via Rockaway Beach Blvd./Beach Channel Drive) |
| | Q53 | Woodside-Rockaway Park (limited stop service) |
| Subway | A | Manhattan-Brooklyn-Queens (via Broad Channel, Rockaways) |
| | S | Rockaway Park Shuttle (via Broad Channel, Rockaways) |
| | L | Manhattan-Brooklyn (Canarsie) |
| | 2 | Bronx-Manhattan-Brooklyn (Flatbush) |
| | 5 | Bronx-Manhattan-Brooklyn (Flatbush) |

**Figure 12 - Broad Channel/Rockaways area transit**
Source: NPNYH[12]


Bicycles are permitted on MTA subway trains at all times during the day, but bicyclists are encouraged not to bring bicycles aboard during rush hour. Currently, only folding bicycles are permitted aboard local and limited buses at all times, and all other bicycles are prohibited. MTA buses currently are not equipped with exterior bicycle racks[13].

In 2008, the New York City Council set aside $1.8 million to help subsidize commuter ferry service between Manhattan and Riis Landing[14]. The service was discontinued in March 2010 when the subsidy ran out. However, City Council Speaker Christine C. Quinn has expressed her commitment to a "five-borough, year round ferry system," which may include resumption of the Riis Landing service in the future[15].

[12] National Parks of New York Harbor Conservancy (2008). New York Harbor Transportation Strategy Building Connections to National Parks and Other Destinations.
[13] NYC MTA. http://www.mta.info/bike/. Accessed March 8, 2010.
[14] New York Times. "A Commute From Rockaway, Now With a Harbor View." http://www.nytimes.com/2008/05/13/nyregion/13ferry.html?_r=1&scp=11&sq=ferry%20Quinn%20%22East%20River%22&st=cse
[15] New York Times. "Rockaway Ferry to Sail Into Sunset." http://cityroom.blogs.nytimes.com/2010/02/23/rockaway-ferry-to-sail-into-sunset/.

### 3.7 Bicycle and pedestrian planning studies

Several studies consider transportation planning for Jamaica Bay, which provide context and precedent for improving and expanding upon the non-motorized networks in Jamaica Bay. The following provides a summary of the most significant studies related to bicycle and pedestrian planning.

**New York City Bicycle Master Plan (NYCDCP/NYCDOT, 1997)** – establishes a bicycle network development plan for New York's neighborhoods. The plan provides essential information related to on- and off-street bicycle facilities, bridges, the Greenway system, access to mass transit, and design guidelines. The plan is among the first to consider planning for the JBG and connections to the Shore Parkway Greenway (west of the study area).

**New York City Street Design Manual (NYCDOT, 2009)** – establishes and standardizes all city transportation policies. In particular, the Street Design Manual provides guidelines and standards for the geometry, materials, lighting, and furniture to be used for all bicycle and pedestrian enhancements.

**Shore Parkway Greenway Connector, Master Plan (NYCDCP, 2005)** – analyzes connections between two sections of the Shore Parkway Greenway that parallel the New York Bay and Jamaica Bay near Coney Island (west of the study area). The report considers area pedestrian and bicycle access, and several options for bicycle facility implementation or improvements. The plan is significant for its analysis of existing conditions, many of which are similar to street networks in the Rockaways and Broad Channel, and for its recommendation to connect the Greenway system throughout New York.

**Jamaica Bay Transportation Studies Development Concept Plan/Environmental Assessment/Assessment of Effect (NPS, 2006)** – proposes improvements to transportation operating conditions in order to provide safe and efficient travel to, and circulation around the sites within the Jamaica Bay Unit. The study mainly considers automobile travel and circulation, but does suggest overall circulation improvements for pedestrians and cyclists, without specific design guidelines. Bicycle and pedestrian recommendations designated as the NPS preferred alternative include:

- At Jacob Riis Park, reconstruction and realignment of the traffic circle prior to the park entrance to improve vehicular circulation and facilitate the construction of a multi-use, protected bicycle connection from the Park entrance and Rockaway Beach Boulevard[16].
- At Riis Landing, improvements to the pedestrian crossing at Rockaway Point Boulevard by re-striping the sidewalk and installing a signalized crossing to access Riis Landing[17].

The first recommendation to reconstruct the traffic circle at Jacob Riis Park is not planned. However, NPS worked with NYCDOT to improve wayfinding signage and lane markings at the traffic circle intersection with Rockaway Beach Boulevard. The second recommendation is similar to the option outlined in this study for safe connections between the west end of Jacob Riis Park at Beach 169th Street and State Road.

**Woodhaven-Cross Bay Boulevard Bicycle Corridor Study (NYCDCP, 2009)** – provides a basis for discussion on some of the most recent planning around the JBG. The study area for that report overlaps and exceeds the majority of the area of study for this effort, and proposes several bicycle routes to

[16] U.S. Department of the Interior National Park Service, U.S. Federal Highway Administration, Eastern Federal Lands Highway Division, Gateway National Recreation Area, Jamaica Bay Unit. Jamaica Bay Transportation Studies: Development Concept Plan/Environmental Assessment/Assessment of Effect. 2006. P.47.
[17] *Ibid.* P. 61.

connect residents of the Woodhaven neighborhood through Broad Channel and the Rockaways with local parks and greenways.

### 3.8 Motorized planning studies

The following studies primarily consider motorized access in Jamaica Bay, and may make general reference to improving pedestrian or bicycle access without offering specific recommendations.

**National Parks of New York Harbor Waterborne Transportation Study (Volpe Center and Cambridge Systematics, 2001)** – assesses the viability of water transportation as an access mode serving Gateway and other assets of the National Parks of New York Harbor, and developed a preliminary ferry service concept plan, including recommended routes and docking locations, to serve the needs of park visitors. Several ferry services have since been piloted.

**Gateway Integrated Transportation Strategy and Implementation Plan (Volpe Center and Norris and Norris Architects, 2004)** – builds upon the 2001 Waterborne Transportation Study by exploring opportunities to increase water transportation to the Gateway National Recreation Area.

**Draft Memorandum from Sam Schwartz PLLC for National Parks of New York Harbor Conservancy, Re: Jamaica Bay Wildlife Refuge Access (September 2007)** – outlines the existing transit available and provides recommendations to improve and expand these services.

**Draft Memorandum from Sam Schwartz PLLC, Re: Jamaica Bay Wildlife Refuge Eco Tours (November 2007)** – examines four existing eco-tour services in urban areas and provides recommendations for implementing a similar service at the Jamaica Bay Wildlife Refuge.

**New York Harbor Transportation Strategy: Building Connections to National Parks and Other Destinations, (Jonathan Rose Companies for National Parks of New York Harbor Conservancy, 2008)** – recommends treatments to improve connections to 23 NPS destinations and many others along New York Harbor. The NPS sites included six within the scope of this particular project: Jamaica Bay, Jacob Riis Park, Fort Tilden, Breezy Point, Floyd Bennett Field, and Canarsie Pier.

### 3.9 Partnerships

NPS supports the development of a continuous greenway around Jamaica Bay that provides safe bicycle and pedestrian connections to its sites and area transit centers. The options detailed in this report require NPS to work with neighborhood advocates and local city agencies that have a mutual interest in enhancing greenway connections, including NYCDOT, NYCDCP, NYC Parks, and MTA.

This study draws upon the extensive transportation planning completed in the area both by the NYCDOT and the NYCDCP, and recognizes shared goals between NPS and NYC Parks in balancing the need for providing access and recreational opportunities to its visitors, while protecting and conserving sensitive habitat and natural resources.

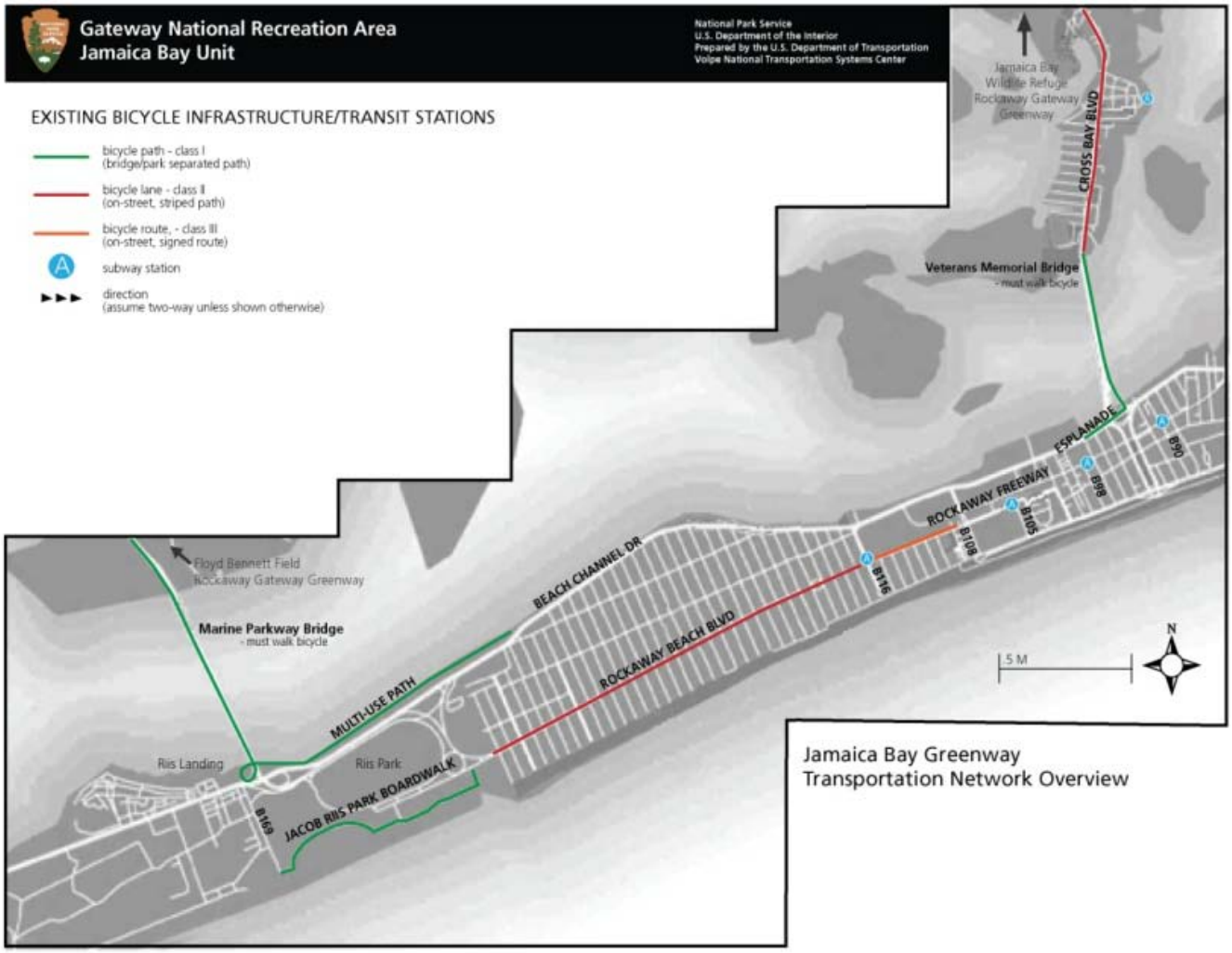
Community stakeholder engagement is also critical. As visitation to the Jamaica Bay Unit and the residential population have both increased, local neighborhood roads are used as entryways to NPS sites, leading to increased traffic congestion in surrounding communities. NPS is sensitive to the issues that arise for gateway communities around Jamaica Bay, and makes an effort to reduce vehicular traffic in area communities, reduce parking demand at NPS sites, and promote safe and sustainable multimodal transportation to NPS sites for pedestrians, bicyclists, and transit users. According to an NPS 2006 transportation study that considered automobile access to, and circulation around Jamaica Bay, the park has had an interest in limiting westbound vehicular traffic through neighborhoods east of Jacob Riis Park[18]. This study promotes alternatives to private vehicle travel to Jamaica Bay attractions, thus decreasing vehicle emissions, and traffic congestion that result from an influx of automobiles to the area during peak visitation.

[18] U.S. Department of the Interior National Park Service, U.S. Federal Highway Administration, Eastern Federal Lands Highway Division, Gateway National Recreation Area, Jamaica Bay Unit. Jamaica Bay Transportation Studies: Development Concept Plan/Environmental Assessment/Assessment of Effect. 2006. P.16.

## Section 4: Transportation network overview

This section provides a qualitative description of roads that lead to, or travel through NPS Jamaica Bay Unit sites within the Broad Channel and Rockaways neighborhoods. They are described in terms of their suitability for pedestrian and bicycle travel, and also consider issues related to access and safety. Field observations helped to inform the study team of potential bicycle route options, as well as pedestrian, transit, and wayfinding infrastructure needs described in later sections. Figure 13 illustrates the major roads and connections that provide the basis for the specific bicycle and pedestrian intervention options.

**Figure 13 - Major roads and connections**
Source: U.S. DOT, Volpe Center



**Broad Channel**

*Cross Bay Boulevard*

Cross Bay Boulevard in the Broad Channel neighborhood connects the Jamaica Bay Wildlife Refuge to the MTA Broad Channel station and the Veterans Memorial Bridge, which leads to the Rockaways and connects to NPS sites around Jamaica Bay. Cross Bay Boulevard is the major travel arterial through Broad Channel, running north-south with two lanes in each direction, and is separated by a planted center median, with a parking lane in each direction, and is approximately 90-110 feet wide, with a speed limit of 30 MPH.

NPS constructed on its property a two-way multi-use path parallel to Cross Bay Boulevard, providing an appealing and safe experience for bicyclists and pedestrians traveling to the Jamaica Bay Wildlife Refuge. Figure 14 illustrates the NPS multi-use pathway that runs in the Refuge parallel to Cross Bay Boulevard north of Broad Channel.

**Figure 14 - NPS multi-use path, Broad Channel**
Source: U.S. DOT, Volpe Center


Cross Bay Boulevard is also flanked with on-road bicycle lanes in both directions. NYCDOT installed five-foot wide striped Class II bicycle lanes that extend to the north side of the Veterans Memorial Bridge. Figure 15 illustrates the bicycle lanes on Cross Bay Boulevard through the Broad Channel neighborhood. The bicycle lanes are well-maintained; however the study team encountered obstructions from commercial vehicles, as shown in Figure 16.

**Figure 15 - Cross Bay Boulevard bicycle lane, Broad Channel**
Source: U.S. DOT, Volpe Center

**Figure 16 - Commercial vehicles on Cross Bay Boulevard bicycle lane, Broad Channel**
Source: U.S. DOT, Volpe Center

The MTA Broad Channel station is located one mile south of the Jamaica Bay Wildlife Refuge Visitor Center, to the east of Cross Bay Boulevard. The station serves as a connection to the MTA "A" line that travels through Brooklyn and Manhattan, with transfer points to other MTA subway lines. There is currently no guide signage denoting the close proximity of the station to the Refuge, which could be improved through wayfinding signage and road markings.

### The Rockaways

*Veterans Memorial Bridge South*

The Veterans Memorial Bridge connects Broad Channel to the Rockaways and has a separated path for bicyclists and pedestrians to walk across. The exit at the southern end of the bridge provides direct pedestrian and bicycle access to the esplanade along Jamaica Bay and other points east and west along Beach Channel Drive, however there is no direct access to the oceanside boardwalk or other popular destinations further south. The entrance to the bridge is located at Beach 92nd Street, yet the nearest crosswalks across Beach Channel Drive are at Beach 90th Street and Beach 101st Street, and bicyclists have to walk their bicycles on sidewalks for at least a portion of the route. Figure 17 illustrates the multi-use ramp connection to the Veterans Memorial Bridge.

**Figure 17 - Veterans Memorial Bridge South, bicycle and pedestrian entrance**
Source: Google, 2009

*Beach Channel Drive*

Beach Channel Drive (BCD) is a primary arterial connector through the Rockaways. The section of BCD between the Marine Parkway Bridge and the Veterans Memorial Bridge is a natural missing link to the Jamaica Bay Greenway. This route provides views of Jamaica Bay, and is the most direct connection between the two bridges.

Current conditions make BCD less than ideal for a bicycle route, including the fact that it is designated as both a major truck route and an evacuation route, with high traffic volume and speeds, limited space for the inclusion of on-road bicycle facilities, and the prevalence of complex weaving traffic patterns at the termini of the bridges. A long term vision for BCD is presented in Section 10.

*Rockaway Freeway*

Rockaway Freeway runs east-west underneath the elevated section of the MTA "A" line. The presence of the elevated tracks reduces the amount of natural light that can penetrate the area, reducing visibility for motorists on this narrow street with frequent intersecting cross streets. In addition, there is virtually no commercial activity on the street, making the area feel isolated. Portions of the sidewalks are in disrepair and many intersections lack crosswalks. These conditions combine to make this road an undesirable location to construct extensive pedestrian and bicycle specific infrastructure. The NYCDCP Woodhaven study confirms this sentiment[19]. Figure 18 illustrates a typical view of narrow travel lanes and the isolated nature of Rockaway Freeway.

**Figure 18 - Rockaway Freeway**
Source: U.S. DOT, Volpe Center

*Beach 108th Street*

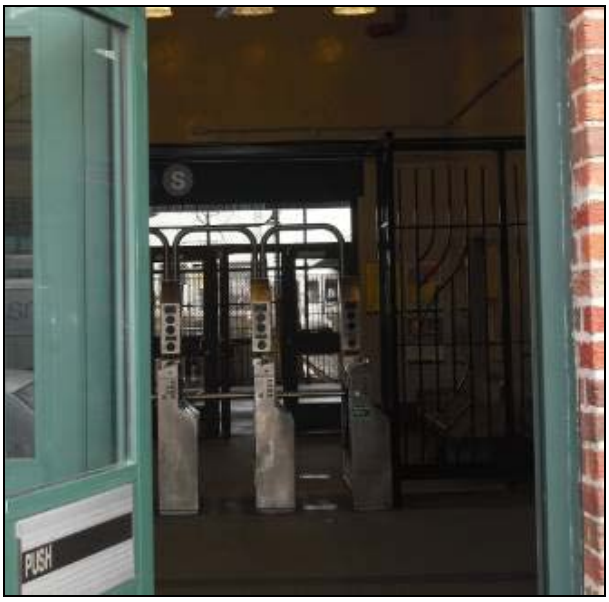
Beach 108th Street runs north/south, connecting BCD with Rockaway Beach Boulevard and the Shore Front Parkway/Boardwalk area. Beach 108th Street is wide enough to accommodate the inclusion of an on-road bicycle lane for northbound and southbound bicycle traffic. This road provides good access for bicyclists to Rockaway Beach Boulevard as a means to travel directly to Jacob Riis Park and other NPS destinations in the area.

*Beach 116th Street*

Beach 116th Street, like Beach 108th Street, runs north/south to connect BCD to the ocean. This highly commercial street has restaurants and retail establishments that could be well served by visitors arriving by bicycle. Beach 116th Street is particularly notable because it is the western terminus of the MTA "A" line. This station is located closest to Jacob Riis Park, and has the benefit of an at-grade entryway, thus alleviating the need for bicyclists to carry their bicycles up or down any stairways (Figure 19), as required at the Beach 105th station and the Beach 98th station. The Rockaway Park-Beach 116th Street station is the preferred station for bicyclists destined for NPS sites in Rockaways.

[19]According to the study, "this roadways in terms of space available, low traffic volume and limited left turns permitted would be great for a Class II bicycle lane, but its lack of attractiveness compared to other streets in the area is found not to be the best corridor for a bicycle route." *New York City Department of City Planning, Woodhaven – Cross Bay Bicycle Corridor Study*. (2009) P. 75.

**Figure 19 - MTA Rockaway Park/Beach 116th Street station entrance**
Source: U.S. DOT, Volpe Center


*Rockaway Beach Boulevard*

Rockaway Beach Boulevard has existing bicycle infrastructure and provides direct access to Jacob Riis Park from Beach 108th Street. Traffic on this road is relatively calm, and the surrounding area includes a mix of residential and commercial property. Parts of the road are relatively narrow, particularly in the eastbound direction to the east of Beach 120th Street where there is no parking. Figure 20 illustrates the shared road markings in this area as guidance to motorists and cyclists between Beach 108th Street and Beach 126th Street. These shared lane markings connect to on-road striped bicycle lanes at Beach 126th Street.

**Figure 20 - Rockaway Beach Boulevard shared road marking**
Source: U.S. DOT, Volpe Center

**Rockaway Beach Boulevard bicycle lanes**

In 2006, NYCDOT installed 1.2 miles of on-road class II bicycle lanes on Rockaway Beach Boulevard from 126th Street to the Jacob Riis Park roundabout. This road provides the most direct route to Jacob Riis Park, and is now used by bicyclists throughout the neighborhood to access area destinations.

With approval from the community, NYCDOT turned a four-lane bypass into a two-lane urban boulevard, converting one travel lane in each direction to a parking and bicycle lane with a buffer to shield bicyclists from cars. The implementation of bicycle lanes in this area helps to cyclists to feel safer while riding on the route, and may increase safety for all road users by decreasing vehicles speeds. These lanes are the most recent addition to the bicycle network in the Rockaways and provide a precedent for the public acceptance of bicycle-specific roadway interventions in the area. Figure 21 illustrates Rockaway Beach Boulevard before and after the addition of bicycle lanes, and the buffered nature of the bicycle lanes along portions of the stretch.

**Figure 21 - Rockaway Beach Boulevard before (left) and after (right)**
Sources: Google, 2007 (Left) and U.S.DOT, Volpe Center (Right)

*Jacob Riis Park Boardwalk*

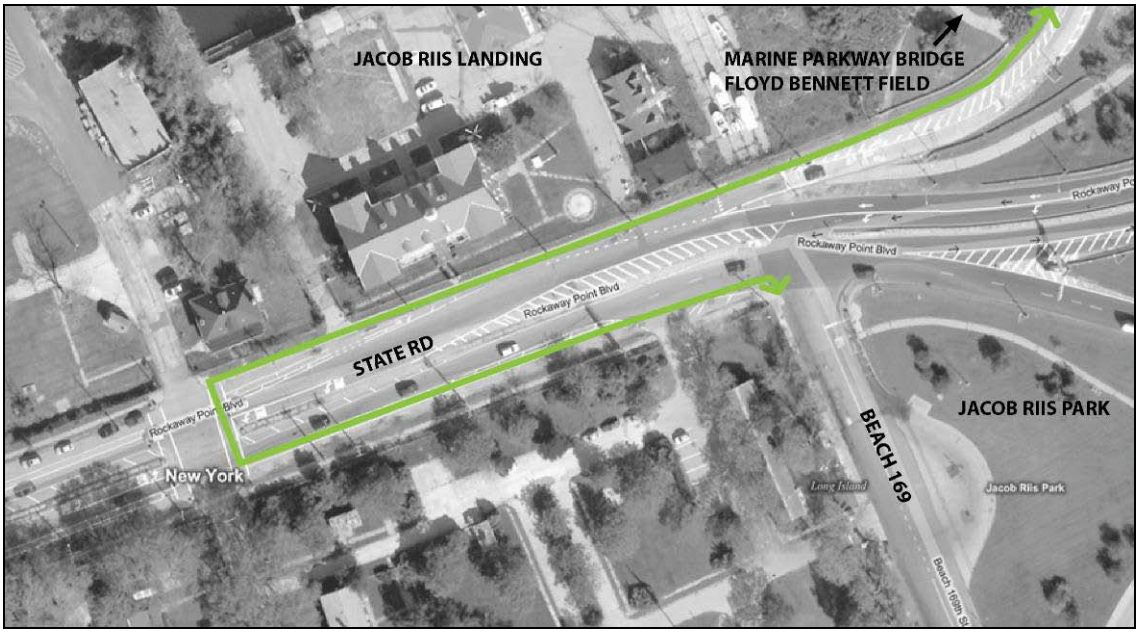
The Jacob Riis Park boardwalk itself provides by far the most aesthetic route through Jacob Riis Park, with incredible views of the Atlantic Ocean and of the iconic mid-20th Century art deco park bathhouses and facilities.

NPS allows bicyclists to ride along the boardwalk. However, there are concerns about the potential for conflicts between cyclists and pedestrians along the boardwalk. Park staff indicates that Jacob Riis Park may become a more popular destination over time, for residents seeking a quieter alternative to Coney Island to the west. An alternative to the boardwalk would require utilization of inland paths.

*Beach 169th Street to the Marine Parkway Bridge*

Beach 169th Street leads from the Jacob Riis Park boardwalk to Riis Landing and the Marine Parkway Bridge, which connects to Floyd Bennett Field. The area around Riis Landing and the entrance to the bridge, however, provides minimal direct access for pedestrians and bicyclists. Crossing State Road is made difficult due to the abundance of bridge on-ramps and off-ramps, and the lack of signalized intersections with crosswalks. Currently, the nearest crosswalk is located just to the west of Riis Landing, allowing for a circuitous route that has bicyclists going away from Riis Landing and from the bridge momentarily before backtracking. When heading towards the bridge, this must be done on the sidewalk. When heading towards Jacob Riis Park, bicyclists may share State Road with vehicles. Figure 22 shows this configuration.

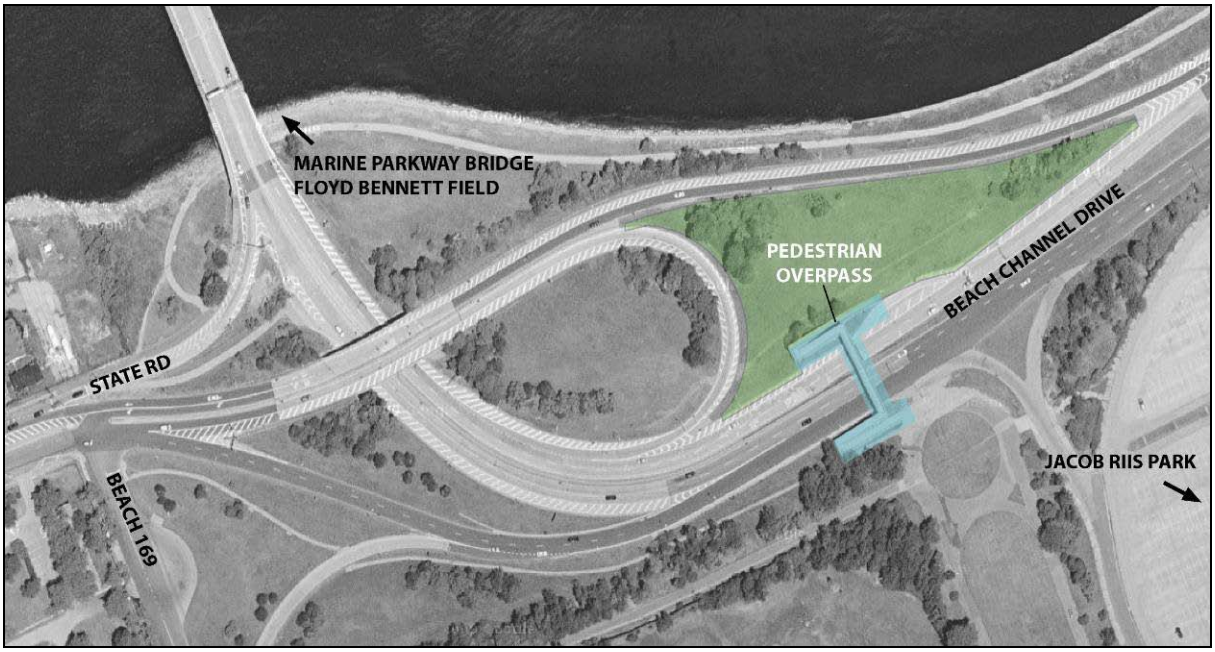
**Figure 22 - Jacob Riis Park, Riis Landing, State Road, Marine Parkway Bridge**
Sources: Google 2009, U.S. DOT, Volpe Center




Traversing the land between Jacob Riis Park and the Marine Parkway Bridge is made more complex by the multitude of ramps that connect area roadways to the Marine Parkway Bridge. The aforementioned route along Beach 169th Street and State Road is the most direct, but absent wayfinding signage pedestrians and bicyclists may find themselves crossing dangerous roads.

The trip is made particularly confusing by the presence of an overpass designed strictly for bicycles and pedestrians to cross over eastbound traffic on Beach Channel Drive that does not make a full connection over the road. Figure 23 illustrates the overpass in blue. The pedestrian bridge overpass leads to an island patch of land, shown in green, which is fully surrounded by ramps and roads, none of which have a safe crossing to access the shore side path on BCD that leads to the entrance of the Marine Parkway Bridge. If no crosswalk is installed, then the overpass should be closed, or, at the very least, bicyclists and pedestrians should be informed that the overpass does not lead to the Marine Parkway Bridge or any other destination. This area holds several other opportunities for pedestrian, bicycle, and wayfinding improvements.

**Figure 23 - Jacob Riis Park to Marine Parkway Bridge**
Sources: Google 2009, U.S. DOT, Volpe Center




*Esplanade on Jamaica Bay side of Beach Channel Drive west of Beach 144th Street*

An existing esplanade runs along the Jamaica Bay side of Beach Channel Drive from the Marine Parkway Bridge east to approximately Beach 144th Street. This pathway provides views of Jamaica Bay. However, the path comes to an abrupt end at Beach 144th Street, and there is no crosswalk nearby to cross over to the south side of Beach Channel Drive. This leaves bicyclists and pedestrians stranded on the north side of Beach Channel Drive with no way to cross over to the south side.

Figure 24 illustrates maintenance issues on the esplanade that runs along the northern edge of Beach Channel Drive heading east from the Marine Parkway Bridge.

**Figure 24 - Maintenance issues on esplanade at Marine Parkway Bridge**
Source: U.S. DOT, Volpe Center

Installation of a mid-block crosswalk would enable pedestrians to take advantage of the esplanade, while still providing them an opportunity to cross back over Beach Channel Drive to proceed through the Rockaways. Pending further investigation as to the feasibility and willingness of NYCDOT to put in a crosswalk, signage should clearly identify where the esplanade terminates, and what alternative options exist so as to reduce the risk of pedestrians crossing Beach Channel Drive illegally in an area of extremely high car speeds.

Table 3 summarizes existing bicycle infrastructure within the study area and notes challenges and access issues on each segment.

**Table 3 - Bicycle infrastructure in study area**
Sources: NYCDOT, U.S. DOT, Volpe Center

| Name | From | To | Facility type | Mileage (approx.) | Notes |
|---|---|---|---|---|---|
| **Cross Bay Blvd.** | 165th St. | Veterans Memorial Bridge | Bicycle lane | 3.5 | Provides access to Jamaica Bay Wildlife Refuge and MTA Broad Channel Station. |
| **Veterans Memorial Bridge** | — | — | Separated/ shared path | 0.70 | Shared use sidewalk - bicycles must dismount. |
| **Shore Front Parkway** | Beach 94th St. | Beach 108th St. | Bicycle lane | 0.75 | Access to this facility from the Veterans Memorial Bridge is difficult from Beach Channel Drive because of the prevalence of alternating one-way street designations. |
| **Rockaway Beach Blvd.** | Beach 108th St. | Beach 126th St. | Shared lane markings | 0.88 | Lane widths are wide, but parking is a barrier to implementing full lanes. Shared use markings provide bicyclists some legitimacy. Provides access to MTA Rockaway Park-Beach 116th St. Station. |
| **Rockaway Beach Blvd.** | Beach 126th St. | Beach 149th St. (approx.) | Bicycle lane | 1.2 | Provides access to Jacob Riis Park. |
| **Ocean Promenade Walkway** | Beach 94th St. | Beach 126th St. | Separated/ shared path | 1.6 | No connection to Jacob Riis Park. Difficult to access from Veterans Memorial Bridge or from the west. |
| **Jacob Riis Boardwalk** | Davis Rd. | Beach 169th St. | Separated/ shared path | 0.70 | Restrictions on bicycle use from 5:00 AM-10:00 AM |
| **Beach Channel Drive** | Rockaway Beach Blvd. | Marine Parkway Bridge | Separated/ shared path | 0.72 | Difficult to access from the east of Beach Channel Drive, from streets to the south, or Jacob Riis Park. Path in need of maintenance. |

## Section 5: Introduction to near term and long term interventions

This section identifies the criteria used by the study team to develop the near term and long term intervention options, and describes how to use the information, how the information is organized, and some general limitations. Field investigations and research on area roadway traffic and safety conditions informed the bicycle and pedestrian infrastructure options.

### 5.1 Bicycle route selection criteria

The route options outlined in the following sections were chosen based on the following criteria:

1. Accessibility to MTA stations and direct path (reduces out of direction travel time) to NPS sites.
2. Connection with existing bicycle facilities[20].
3. Safest route for bicycle users.

Where bicycle facilities options are presented (e.g. Class I, II, and III), existing roadway widths were considered. Thus, where Class II on-road facilities are presented, it is assumed there is sufficient width to accommodate the bicycle lane without the need to remove parking.

### 5.2 Multi-use path and pedestrian route selection criteria

The focus of this study is bicycle route connections; however, there is a need for pedestrian accommodations in certain sections of the identified bicycle routes. Generally, improvements to pedestrian infrastructure can have the added benefit of assisting bicyclist operations under complex road conditions.

In certain areas, a multi-use path is a viable option where existing roadway conditions prohibit a separate bicycle facility or where the construction of a new facility could be designed to serve both users. In these cases, opportunities to improve the pedestrian realm through pedestrian-specific or multi-use path configurations are provided.

The routes were identified based on the following criteria:

- Accessibility to MTA and NPS sites.
- Safest route for pedestrians.

### 5.3 How to use this information

The research yields near term and long term intervention options that denote the broad feasibility associated with implementation. The near term intervention options are those that:

- Are physically feasible under current conditions.
- Require little to no construction.
- Could be completed within years through cooperation with NYCDOT and other agencies as necessary.

The long term intervention options require significant planning, construction, and funds. The long term vision takes an innovative approach to enhancing bicycle and pedestrian access, and improving streetscape conditions, area water quality, mobility, and safety on Beach Channel Drive. These long term interventions may take decades to implement.

[20] The NYC Cycling Map was referenced for connections with existing and planned/proposed bicycle infrastructure.

The sections on near term and long term intervention options are organized as follows:

1. **Area/route introduction** provides a general description of the area and route options, including existing conditions and major conflicts.
2. **Near/Long term planning vision** describes the rationale for interventions in the area, highlighting specific planning issues, environmental considerations (e.g. Jamaica Bay water quality issues), and community needs.
3. **Section intervention options** provide an overview of particular segments on the proposed route, including the pros and cons of specific alignments for bicycle facilities.

### 5.4 Limitations and general notes

This report is based on field investigations and engineering considerations. However, there are some general limitations to the options presented in the study, including:

- **Detailed traffic analyses of the area streets were not completed.** The addition of bicycle lanes or other infrastructure needs to be considered against current and projected traffic volumes, and level of service of the street segment or intersection.
- **Plan detail is limited.** The per-mile details of bicycle lane striping and the number of signs are not provided and require further consideration.
- **Cost estimates are based on national estimates.** Local up-to-date cost estimates need to be considered at the time of project implementation.

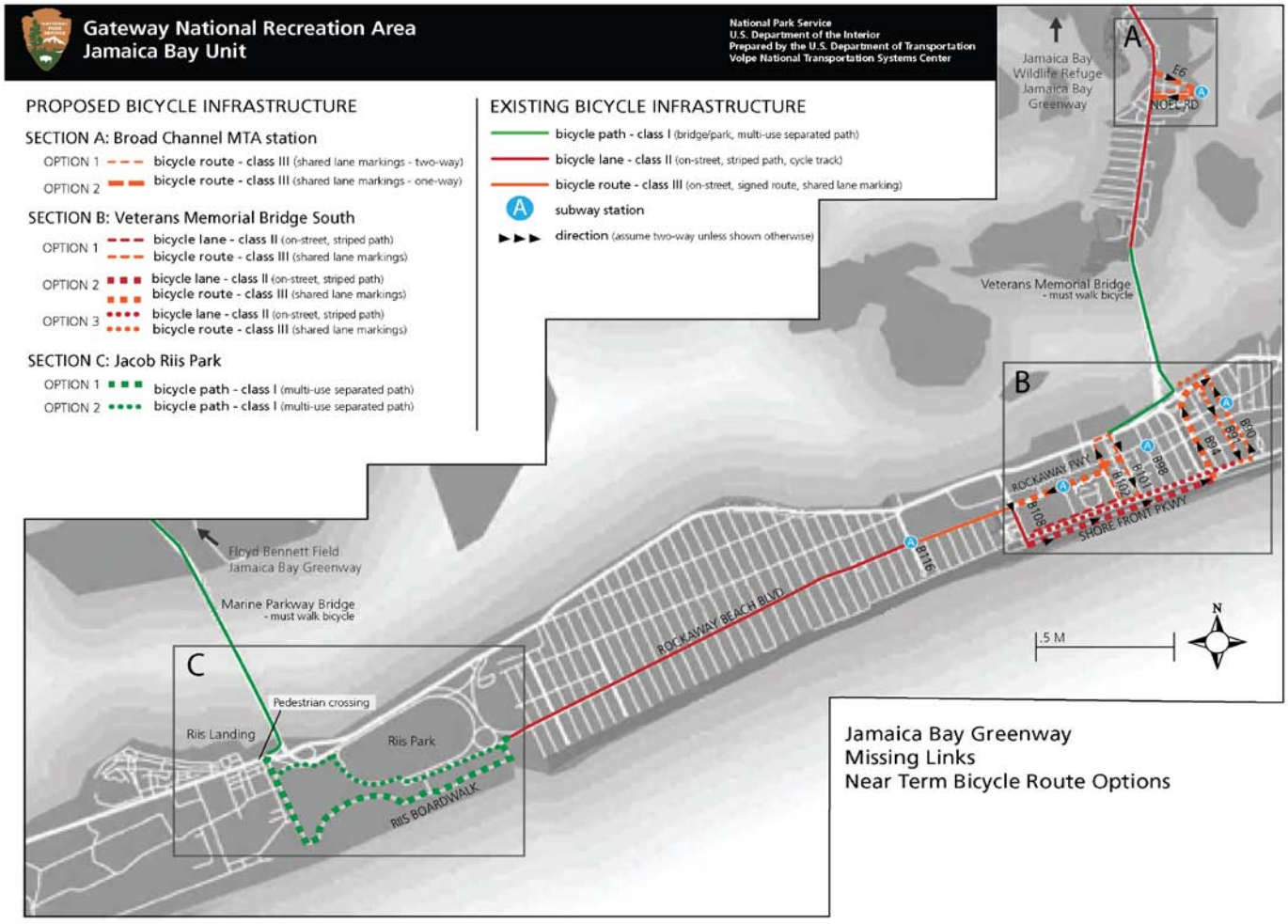
## Section 6: Near term interventions

### 6.1 Area/route introduction

This section identifies near term bicycle infrastructure interventions through Broad Channel and the Rockaways. The majority of treatments in this section involve the provision of roadway markings (i.e. bicycle lanes or shared lane markings) and signage. Treatments would not remove parking and do not require significant construction. The goal of the near term intervention options is to enhance bicycle and pedestrian access between NPS sites and transportation hubs at minimal cost and with minimal disruption to traffic and to local residents.

Figure 25 illustrates the near term route options that would provide connections between NPS sites in Jamaica Bay and the regional transportation network, including the existing JBG.

**Figure 25 – Near term bicycle route/intervention options**
Source: U.S. DOT, Volpe Center



## 6.2 Near term planning vision

The near term vision for cyclists and pedestrians completes the missing links in the JBG in Broad Channel and the Rockaways. A comprehensive network of safe, efficient, high-quality non-motorized facilities will not only increase visitation to NPS sites, but will do so in a manner that reduces congestion, parking demand, and environmental degradation.

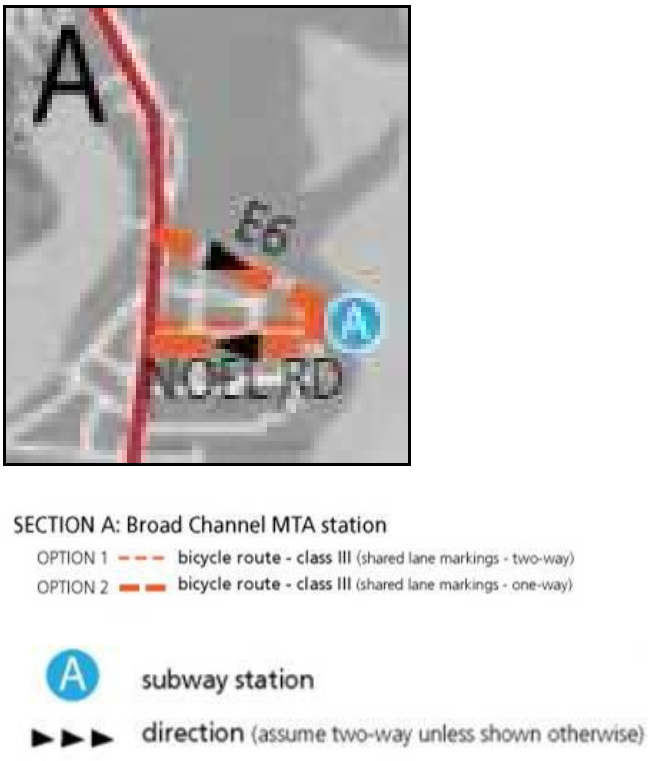
One of the main east-west routes in the Rockaways is Beach Channel Drive. However, a lack of safe and efficient accommodations on Beach Channel Drive currently poses significant challenges for bicyclists. Therefore, Beach Channel Drive is not considered in the near term vision, but is instead considered as part of a a long term approach as described in Section 10.

## 6.3 Section intervention options

### Section A: MTA Broad Channel station

Two options are identified to circumnavigate the Broad Channel neighborhood to proceed to and from the MTA station. The first utilizes the sole two-way street in the community, Noel Road, while the second option includes partial usage of East 6th Road. See Figure 26 for maps of these options.

**Figure 26 - Section A: MTA Broad Channel station route options**
Source: U.S. DOT, Volpe Center



**Option 1: Noel Road**
*Class III, shared lane markings, two-way*

This option would route bicyclists to and from the neighborhood's main thoroughfare, Cross Bay Boulevard, and the MTA Broad Channel station along Noel Road, as denoted in Figure 27. The bicycling environment can be improved with Class III shared lane markings. Noel Road ranges from 27-33 feet wide for two-way travel, including parking on both sides, and therefore cannot accommodate a standard-width bicycle lane.

**Figure 27 - Section A: MTA Broad Channel station access, route option 1**
Source: Google, 2009, U.S. DOT, Volpe Center


**Pros:**

- Most direct connection from MTA Broad Channel station to Cross Bay Boulevard.
- Minimizes number of residents who will be directly affected, since this option covers the least amount of streetscape.

**Cons:**

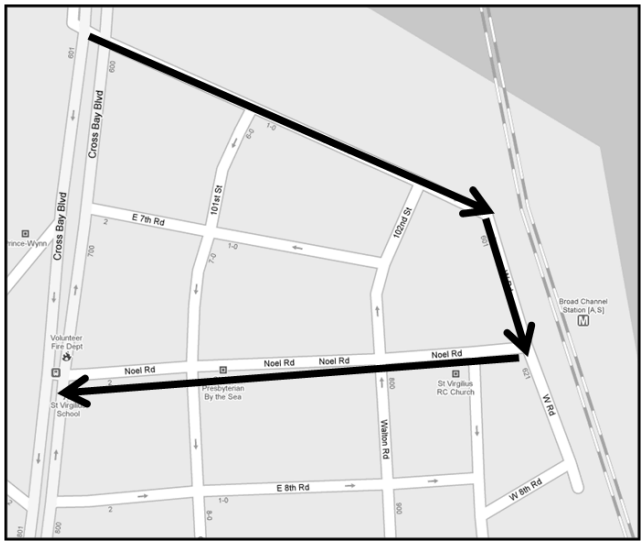
- Noel Road is narrow, with widths ranging from 27-33 feet, and curbside parking on both sides of the street.

### Option 2: East 6th Road loop

*Class III, shared lane markings, one-way*

A less direct route option is to create a loop where cyclists would approach the MTA station on the one-way East 6th Road just north of the station, and exit the station heading west on Noel Road. This alignment is shown in Figure 28.

**Figure 28 - Section A: MTA Broad Channel station access, route option 2**
Sources: Google, 2009, U.S. DOT, Volpe Center




**Pros:**

- Eliminates two-way bicycle traffic. Roads in this neighborhood may be too narrow to accommodate bicycle traffic in two directions.

**Cons:**

- Less direct route. Cyclists approaching from the south would proceed past two-way Noel Road to access East 6th Road.

### Section B: Veterans Memorial Bridge South

The southern access point to the Veterans Memorial Bridge does not feed directly to any continuous bicycle paths. This report identifies three options for bicyclists. The first option utilizes the existing esplanade and Beach 101st Street and Beach 102nd Street. The second option utilizes a combination of the esplanade, Beach Channel Drive, and local streets in the westbound direction. For travel east, cyclists would ride on Shore Front Parkway, Beach 94th Street, and Beach Channel Drive. The third option requires cyclists to proceed east on Beach Channel Drive to Beach 90th Street and Beach 91st Street. Figure 29, Figure 30, and Figure 31 outline each respective option, with further elaboration to follow.

**Figure 29 - Section B: Veterans Memorial Bridge South, route option 1**
Source: U.S. DOT, Volpe Center

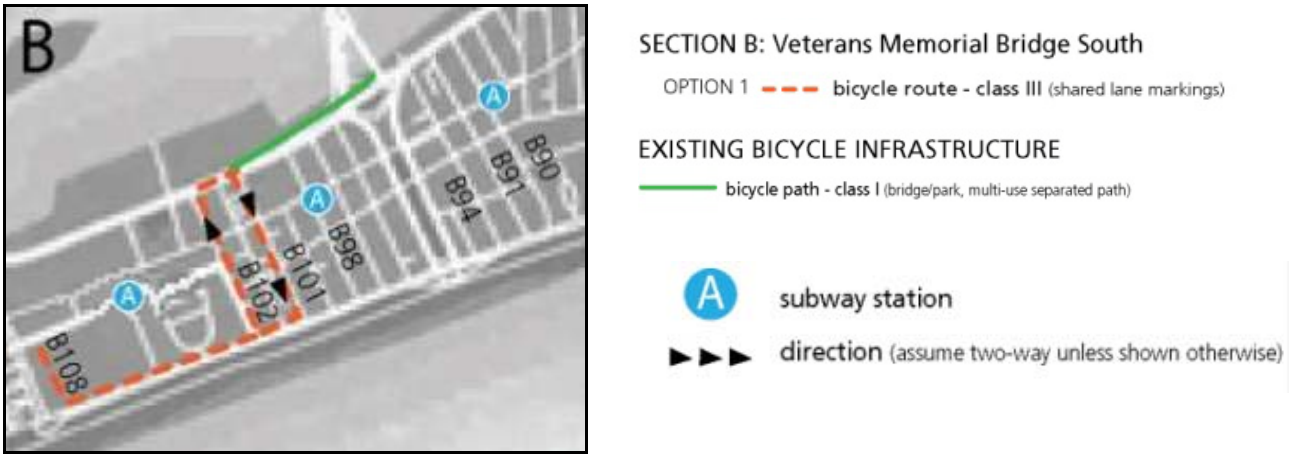



**Figure 30 - Section B: Veterans Memorial Bridge South, route option 2**
Source: U.S. DOT, Volpe Center

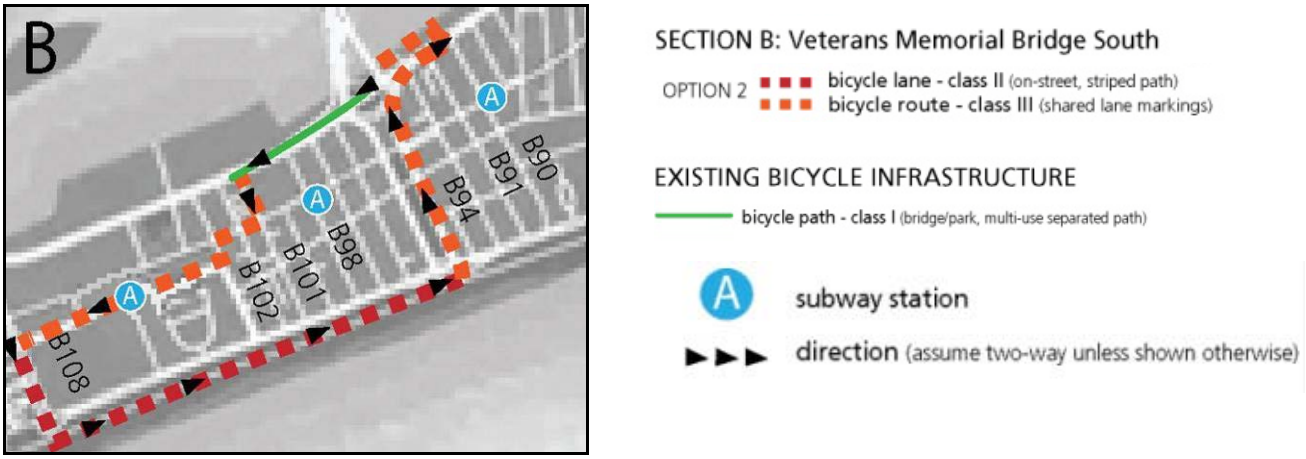
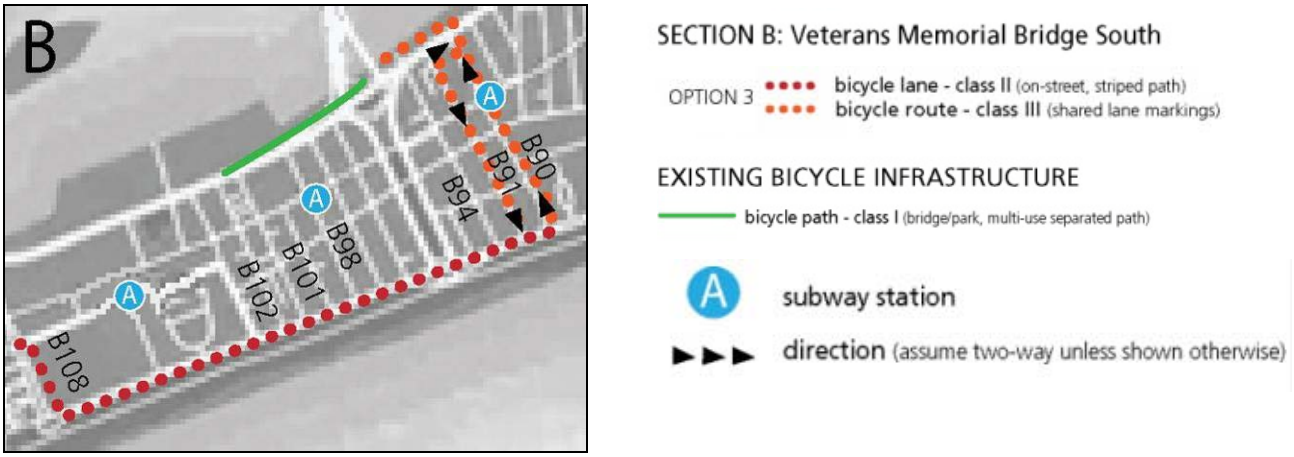


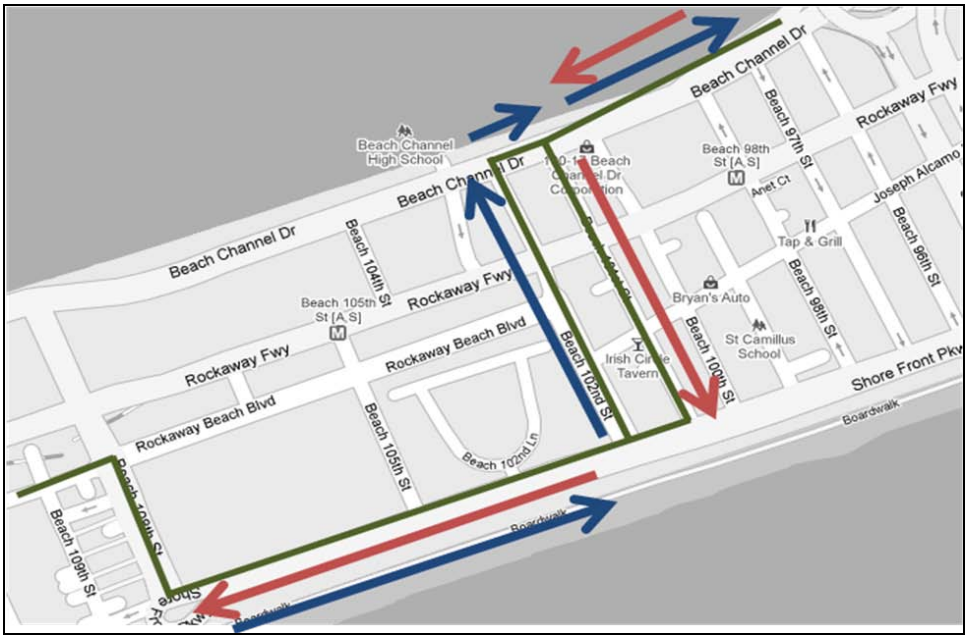
**Figure 31 - Section B: Veterans Memorial Bridge South, route option 3**
Source: U.S. DOT, Volpe Center




**Option 1: Esplanade Beach 101st Street (southbound) and Beach 102nd Street (northbound)**
*Multi-use shared path and Class III, shared lane markings*

This option, shown in Figure 32, utilizes the esplanade, a Class I multi-use separated path underneath the bridge along the Jamaica Bay waterfront. West of Beach 98th Street, where the path ends, cyclists will dismount and walk their bicycles to the crosswalk at Beach 101st Street. Bicyclists continue southbound on Beach 101st Street (Class III) to Shore Front Parkway. Northbound cyclists ride on Beach 102nd Street (Class III) to Beach Channel Drive.

**Figure 32 - Section B: Veterans Memorial Bridge South, route option 1**
Sources: Google,2009 , U.S. DOT, Volpe Center




**Pros:**

- Esplanade itself provides a safe bicycling environment.
- Views of Jamaica Bay.
- Direct, linear access to existing bicycle lanes on Shore Front Parkway from Beach 101st Street and Beach 102nd Street.

**Cons:**

- Esplanade terminates at a sidewalk along Beach Channel Drive at Beach 98th Street, in the vicinity of Beach Channel High School, and a full three blocks east of the nearest crosswalk at Beach 101st Street.
- Bicyclists must walk their bicycles for three blocks from Beach 98th Street to Beach 101st Street[21].

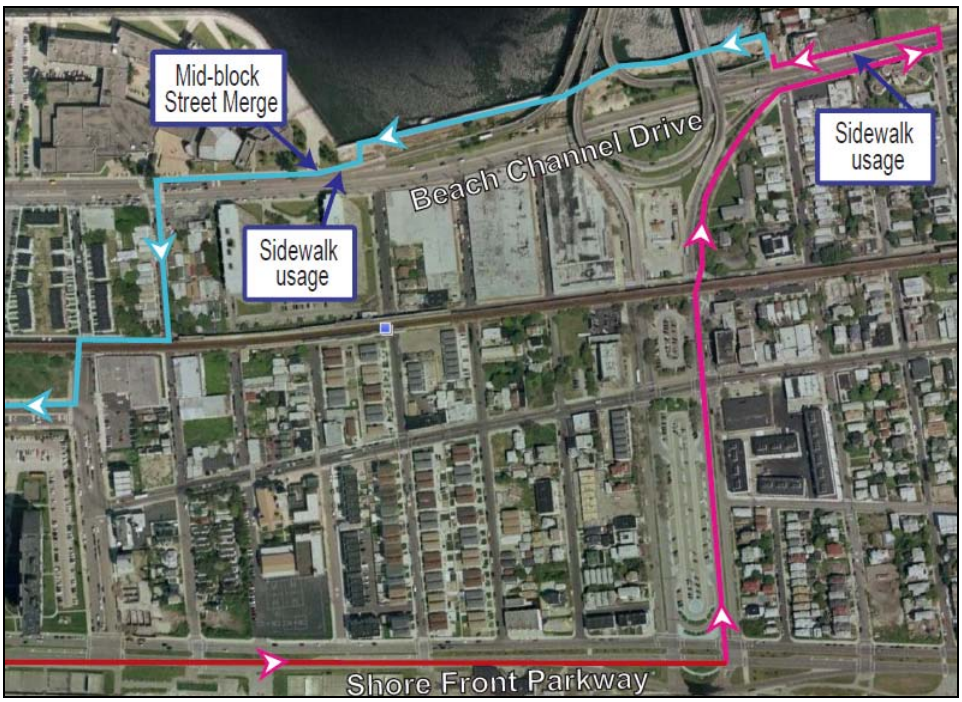
### Option 2: Esplanade westbound, Shore Front Parkway and Beach 94th Street eastbound

*Class III, shared lane markings*

This option was developed in conjunction with NYCDOT during preliminary planning discussions. Under this option, bicyclists proceeding westbound would use the esplanade and merge onto Beach Channel Drive temporarily. They would then use the crosswalk and proceed south on Beach 101st Street before turning right on Rockaway Freeway, then left on Beach 102nd Street, and finally right onto Rockaway Beach Boulevard. Rockaway Beach Boulevard has existing shared lane markings from Beach 108th Street to Beach 126th Street, and transitions to a road striped bicycle lane from Beach 126th Street to Jacob Riis Park.

Eastbound bicyclists would be routed from Shore Front Parkway left onto Beach 94th Street, to merge with Beach Channel Drive east of the Veterans Memorial Bridge. Bicyclists would cross at the Beach 90th Street crosswalk, and use the sidewalk to return to the entrance to the Bridge, as described in Figure 33.

**Figure 33 - Section B: Veterans Memorial Bridge South, route option 2**
Sources: Google, 2009, NYCDOT, U.S. DOT, Volpe Center




[21] Bicyclists are not allowed to ride on sidewalks in New York City. http://www.nyc.gov/html/dot/html/bicyclists/biketips.shtml.

**Pros:**

- All street crossings are traffic controlled with existing signs and signals.
- Does not require use of Shore Front Parkway heading westbound, which has a buffer for cyclists but is not clearly marked as a bicycle lane.
- Incorporates use of the esplanade.

**Cons:**

- Requires bicycle usage along Beach Channel Drive in the vicinity of the bridge off-ramps and on-ramps, which is potentially dangerous.
- Requires cyclist to merge with Beach Channel Drive using a mid-block driveway ramp. There are no traffic lights on Beach Channel Drive between Beach 90th Street and Beach 101st Street, which suggests that through traffic with which bicyclists would be merging may be moving at high speeds.
- Bicyclists have to ride on Rockaway Freeway.

### Option 3: Beach 90th Street and Beach 91st Street

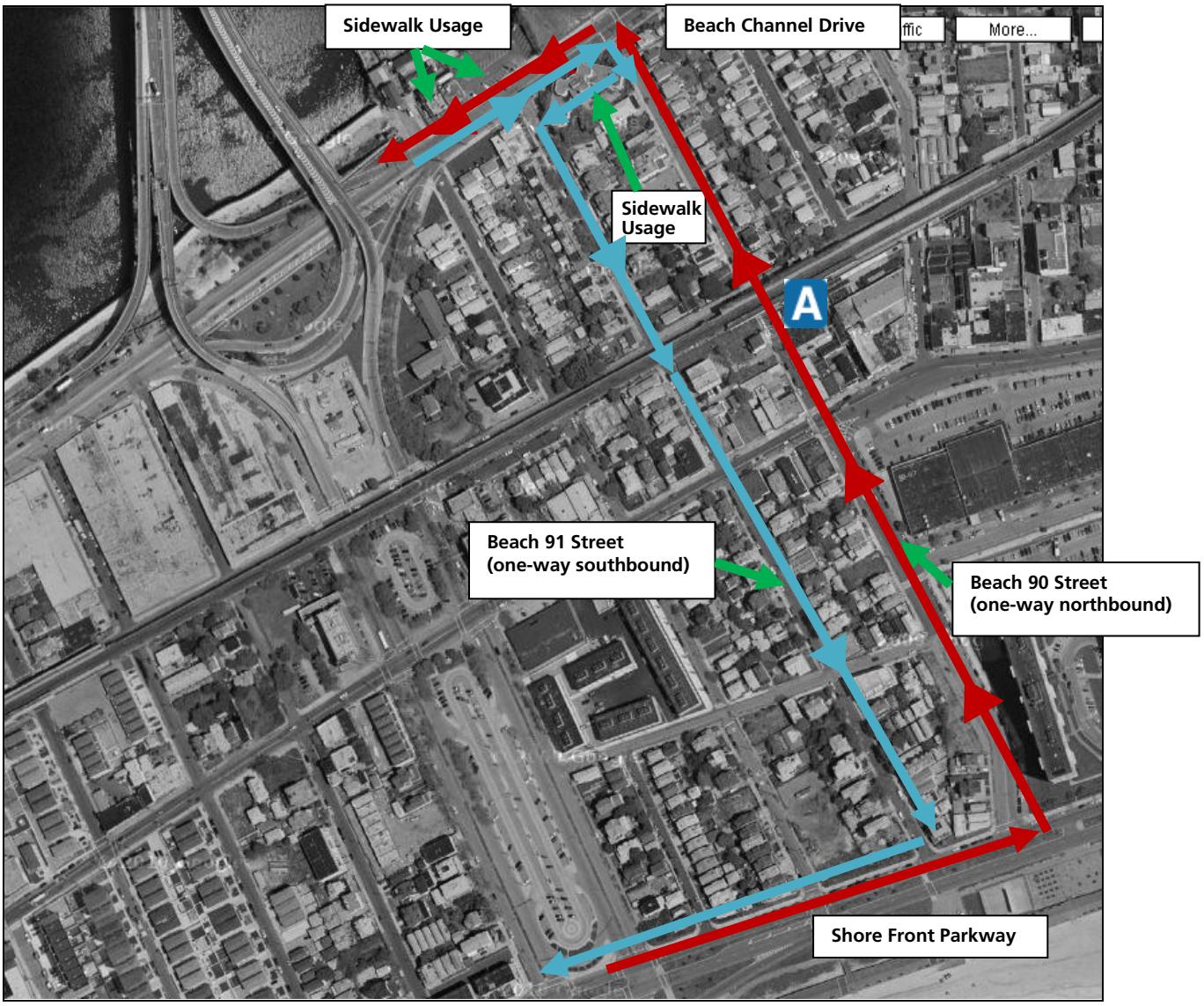
*Class III, signed route*

Another alternative directs bicyclists traveling southbound to walk their bicycles east on the sidewalk adjacent to Beach Channel Drive to a crosswalk at Beach 90th Street. Beach 90th Street has parking on both sides, and provides a direct northbound route from the ocean side of the Rockaways. A parallel route on Beach 91st Street could serve southbound bicyclists.[22]

Figure 34 illustrates these northbound and southbound bicycle route options.

[22] Beach 90th Street and Beach 91st Street are the only feasible north-south routes in this area. The street grid becomes more disconnected further east and would bring bicyclists further away from points of interest. Any option west of Beach 90th Street and Beach 91st Street is too close to the high-speed, high-volume bridge ramps to place a crosswalk.

**Figure 34 - Section B: Veterans Memorial Bridge South, route option 3**
Sources: Google, 2009, U.S. DOT, Volpe



**Pros:**

- Utilizes traffic-controlled street crossings with existing signs and signals.
- Avoids cycling on Beach Channel Drive and Rockaway Freeway.
- Shore Front Parkway is more accommodating to pedestrians and cyclists than Rockaway Beach Boulevard between Beach 102nd Street-Beach 108th Street, and provides a much more aesthetically pleasing environment because of its ocean views.
- Route is similar and direct for both directions, thus reducing confusion and potentially leading to cost savings for wayfinding signage.
- Avoids cycling on Beach 94th Street, which has jersey barriers restricting traffic near the police station, and may have higher vehicle speeds as it is a direct access route for the Veterans Memorial Bridge. Additionally, Beach 94th Street north of Rockaway Freeway narrows and curves in such a manner that increases the potential for vehicle-bicycle conflicts.
- Avoids the sidewalk west of the esplanade in the vicinity of Beach Channel High School, which is both narrow and often busy with foot traffic.

**Cons:**

- There would still be a need to utilize the sidewalk for two or three blocks from the base of the bridge to the crosswalk at Beach 90th Street. However, given that the Esplanade ends west of the bridge, there is no feasible route that could avoid the sidewalk completely given the existing infrastructure. This option uses less of the sidewalk, and a portion of the sidewalk away from the local high school where more pedestrian interference could be expected.
- Requires use of westbound cycling on Shore Front Parkway, where a sufficient buffer exists, but in the form of "hashmarks" rather than a Class II bicycle facility.
- Does not utilize the Esplanade.

### Section C: Jacob Riis Park

This report identifies two options to navigate around Jacob Riis Park. One option utilizes the boardwalk, and one option utilizes interior roads and pathways. Figure 35 shows both of these options.

**Figure 35 - Section C: Jacob Riis Park**
Source: U.S. DOT ,Volpe Center


SECTION C: Jacob Riis Park

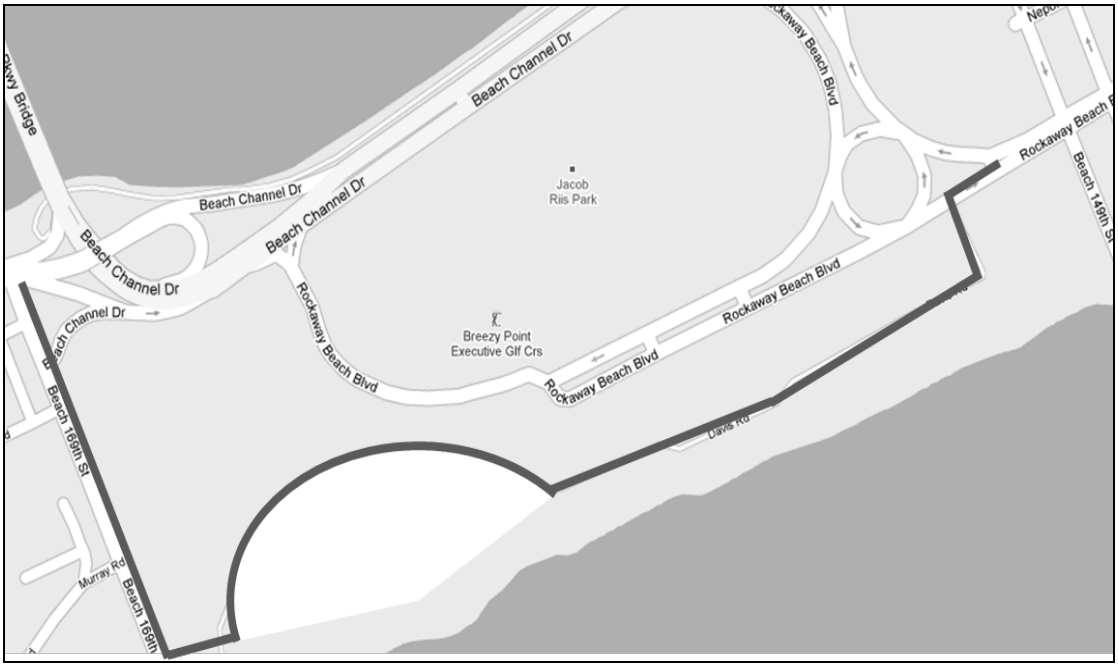
OPTION 1 ■ ■ ■ **bicycle path - class I** (multi-use separated path)
OPTION 2 ●●●● **bicycle path - class I** (multi-use separated path)

►►► **direction** (assume two-way unless shown otherwise)

**Option 1: Boardwalk**
*Multi-use path*

The boardwalk is easily accessible via Rockaway Beach Boulevard, and some signage is already in place denoting this as a bicycle route. The boardwalk terminates at Beach 169th Street, which provides a safe, direct path to Riis Landing and to the Marine Parkway Bridge. This boardwalk route is shown below in Figure 36.

**Figure 36 - Section C: Jacob Riis Park, route option 1**
Sources: Google, U.S. DOT, Volpe Center




**Pros:**

- Views of Atlantic Ocean.
- Bicyclists are currently permitted to ride within Jacob Riis Park and on its boardwalk.
- Most direct and arguably safest refuge for bicyclists who may otherwise become confused and put in harm's way trying to circumnavigate the roads in the vicinity of the park and beach.

**Cons:**

- Very little wayfinding signage in this area, particularly for bicycles.
- NPS is rightly concerned about the interaction between bicycles and pedestrians, particularly during the beach's peak season when the beach gets crowded.[23] Therefore, it is considering a prohibition on riding bicycles during summer weekends between Independence Day and Labor Day. During these times, bicyclists would have to be instructed to walk their bicycles or seek an alternate route.

[23] Personal communications with NPS Gateway NRA Jamaica Bay Unit.

**Option 2: Inland path**
*Multi-use path*

The alternative route to the boardwalk itself involves a series of sidewalks and pathways. The route, outlined below in Figure 37, continues west along Rockaway Beach Boulevard until it merges with a sidewalk at the northern (inland) side of the Riis Park bathhouses and other facilities. From there, bicyclists would continue on the pathways along this interior strip of land until it merges with Beach 169th Street in close proximity to the Marine Parkway Bridge and Riis Landing.

**Figure 37 - Section C: Jacob Riis Park, route option 2**
Sources: Google, U.S. DOT, Volpe Center

**Pros:**

- Because many of these sidewalks are on NPS land, New York City restrictions on bicycle riding do not apply.
- This facility would be open at all times, as opposed to the Boardwalk route which may be closed at NPS discretion on busy weekends and major holidays.

**Cons:**

- Greater interaction with vehicles, especially in the vicinity of the parking lot.
- Prevents bicyclists from seeing direct views of the Atlantic Ocean.

**Riis Landing / State Road / Marine Parkway Bridge**
*Class III, shared lane markings and pedestrian crossing*

An un-signalized, mid-block crosswalk would provide for a seamless transition from Beach 169th Street to Riis Landing and to the entrance of the Marine Parkway Bridge. This crosswalk should have a protected island median, which would minimize the risk when crossing State Road. More analysis needs to be performed to determine speeds of drivers in the area, particularly among those exiting the bridge, to determine whether such a crosswalk is feasible. A schematic of the crosswalk is provided below in Figure 38.

**Figure 38 - Section C: Jacob Riis Park, Riis Landing, State Road, Marine Parkway Bridge, mid-block crossing**
Source: Google, 2009, U.S. DOT, Volpe Center

## Section 7: Pedestrian infrastructure

Pedestrians seeking to traverse the study area can generally utilize the same routes outlined for bicycles, with few exceptions. This section identifies a few select areas with pedestrian conflicts. Figure 39 provides a map, and Table 4 describes their respective locations.

**Figure 39 - Pedestrian conflict areas**
Source: U.S. DOT, Volpe Center

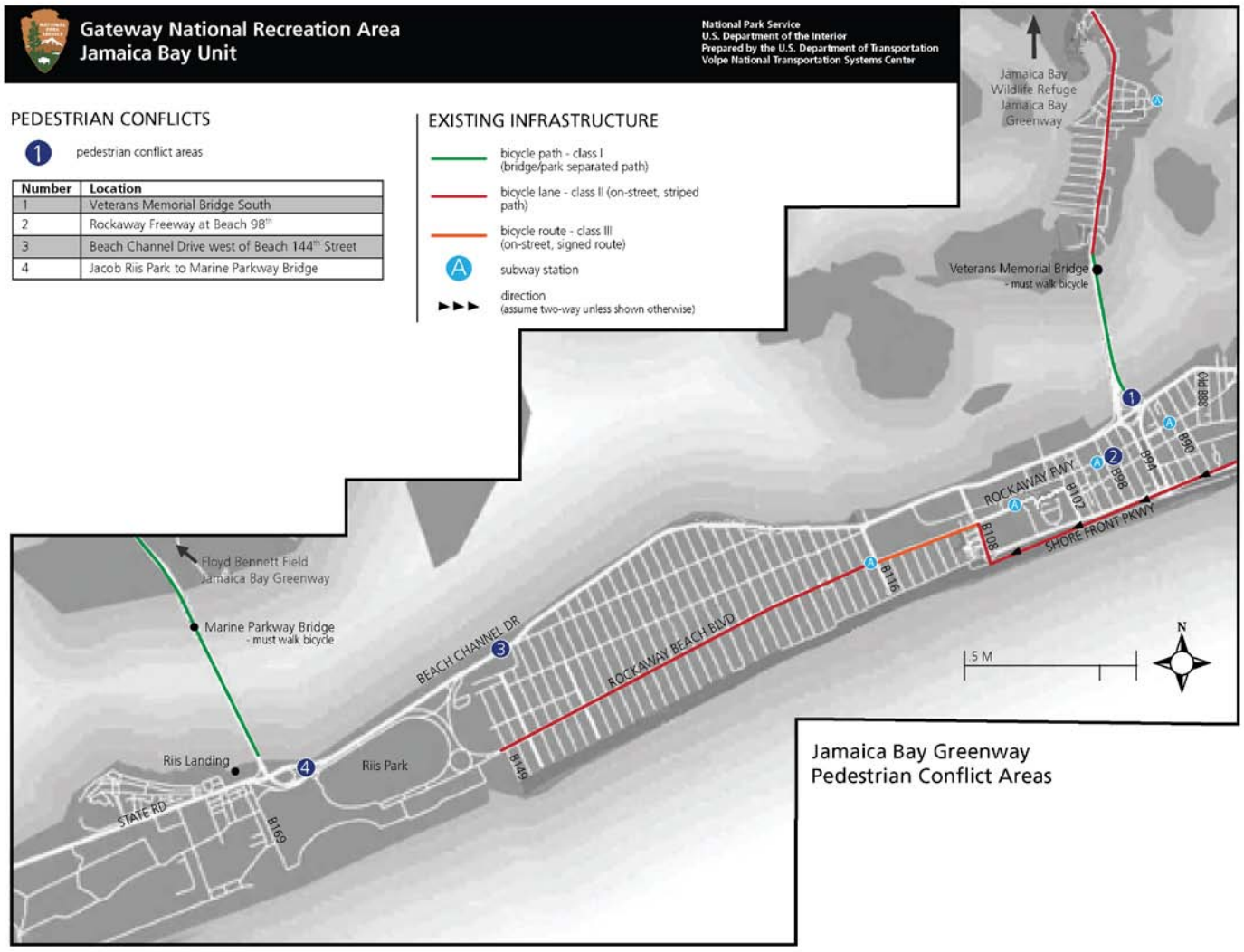


**Table 4 - Pedestrian infrastructure needs locations**
Source: U.S. DOT, Volpe Center

| Number | Location |
|---|---|
| 1 | Veterans Memorial Bridge South |
| 2 | Rockaway Freeway at B98 |
| 3 | Beach Channel Drive west of Beach 144th Street |
| 4 | Jacob Riis Park to Marine Parkway Bridge |

### Veterans Memorial Bridge South

Crossing Beach Channel Drive in this area can be treacherous because of its proximity to entrance and exit ramps onto and off of the bridge itself, as shown in Figure 40, where the pedestrian ramp is outlined in red. Therefore, installing a crosswalk at Beach 92nd Street, where the bicycle and pedestrian path for the bridge is located, would be dangerous. However, there may be opportunities to either have the path begin further south of Beach Channel Drive or to implement a redesign of Beach Channel Drive itself that incorporates traffic calming elements more accommodating of bicyclists and pedestrians.

The area would also benefit from better directional signage, which may reduce the frequency of illegal movements across Beach Channel Drive given the absence of a crosswalk nearby.

**Figure 40 - Southern base of Veterans Memorial Bridge bicycle and pedestrian path**
Source: Google, 2009

### Rockaway Freeway

Rockaway Freeway is generally unappealing to pedestrians for several reasons. First, it is located underneath the elevated section of the "A" line, which reduces the amount of natural light that can penetrate the area. Second, portions of the sidewalks are in a state of disrepair. Third, there is virtually no commercial activity. Finally, not every intersection has a crosswalk, and those that do still introduce hazards due to the high speeds of vehicles traversing the Freeway. Figure 41 shows a typical section of Rockaway Freeway.

**Figure 41 - Rockaway Freeway**
Source: U.S. DOT, Volpe Center

### Beach Channel Drive west of Beach 144th Street

The esplanade along Jamaica Bay north of Beach Channel Drive that extends from the Marine Parkway Bridge in the west to the vicinity of Beach 144th Street in the east ends abruptly (see Figure 42), as a curve in that area brings Beach Channel Drive up against Jamaica Bay itself. Pedestrians are not informed about this pattern shift, nor is there any existing alternate route to cross over Beach Channel Drive.

**Figure 42 - Beach Channel Drive esplanade at Beach 149th Street**
Source: U.S. DOT, Volpe Center

The walk between Jacob Riis Park and the Marine Parkway Bridge is made particularly confusing by the presence of an overpass designed strictly for bicycles and pedestrians to cross over eastbound traffic on Beach Channel Drive, shown in Figure 43. However, this overpass leaves bicyclists and pedestrians on an island patch of land that is fully surrounded by ramps and roads, none of which have a crosswalk or a safe place to cross.

**Figure 43 - Beach Channel Drive near Marine Parkway Bridge, north of Jacob Riis Park**
Source: Google, 2009

## Section 8: Transit station infrastructure

Bicyclists traveling on the subway to Broad Channel or the Rockaways destined for Jamaica Bay Unit sites are most likely to use one of four MTA stations: Broad Channel, Beach 98th Street, Beach 105th Street, or Rockaway Park-Beach 116th Street. This section identifies transit access considerations and provides suggestions for improving bicycle accommodations at transit stations.

Field observations considered station access in terms of convenience and the availability of route signage. The study team identified several options for facilitating enhanced multimodal connections between transit stations and Jamaica Bay Unit sites. They include:

- Installing bicycle parking.
- Installing bicycle stair channels.
- Improving wayfinding signage guiding bicyclists from MTA stations to NPS sites.

### Bicycle parking

On-street or in-station bicycle parking is not provided at any of the MTA stations in the study area. Providing safe and convenient bicycle parking at transit locations encourages multimodal trips. Racks should be located in high-visibility areas convenient to entrances/exits, with proper lighting conditions and sufficient space for storing and maneuvering bicycles.

### Bicycle stair channels

The MTA Rockaway Park-Beach 116th Street station is located at street level, and provides the most convenient option for bicyclists traveling to all Jamaica Bay Unit sites in the Rockaways. The MTA Beach 98th Street and Beach 105th Street stations are elevated from the street, and are accessible only by stairways. At these locations, bicycle stair channels would increase bicyclist accessibility. Bicycle stair channels allow bicyclists to push rather than carry their bicycles up stairs, thus reducing the risk of dropping a bicycle, or unintentionally colliding with people.

Figure 44 illustrates the stairways at MTA Beach 98th Street station and MTA Beach 105th Street station. Figure 45 illustrates the use of bicycle stair channels.

**Figure 44 - MTA Beach 98th Street station (left) and MTA Beach 105th Street station (right)**
Source: U.S. DOT, Volpe Center



**Figure 45 - Bicycle stair channel**
Source: Bay Area Bicycle Coalition

## Section 9: Wayfinding infrastructure

The Jamaica Bay Unit at Gateway has a number of destinations worth visiting, and they are within relative proximity to many key transportation hubs. Currently, there is no NPS-specific wayfinding signage at any of the aforementioned MTA stations. Wayfinding around these transit stations increases visibility of NPS sites in the area and helps to attract visitors to these locations. New signage can help to encourage multimodal alternative transportation, aid motor vehicle traffic, and strengthen the identity of the Jamaica Bay Unit and its surrounding communities.

The wayfinding strategy that accompanies this study of the missing links in the Jamaica Bay Greenway seeks to highlight these NPS sites as well as the transportation hubs. As such, Table 5 identifies nodes of interest.

**Table 5 - Wayfinding destination nodes**
**Source: U.S. DOT, Volpe Center**

| Destination Nodes |
|---|
| Jamaica Bay Greenway |
| Jamaica Bay Wildlife Refuge |
| MTA Broad Channel Station |
| MTA Rockaway Park-Beach 116th Street Station |
| Riis Park |
| Riis Landing |
| Fort Tilden |
| Floyd Bennett Field |
| Canarsie Pier |

This report identifies 16 locations, mapped in Figure 46 and identified in Table 6 that would benefit from signage. These locations include attractions, as well as key decision points along the proposed short-term route for anyone visiting Gateway on bicycle or on foot.

**Figure 46 - Proposed wayfinding signage locations**
Source: U.S. DOT, Volpe Center

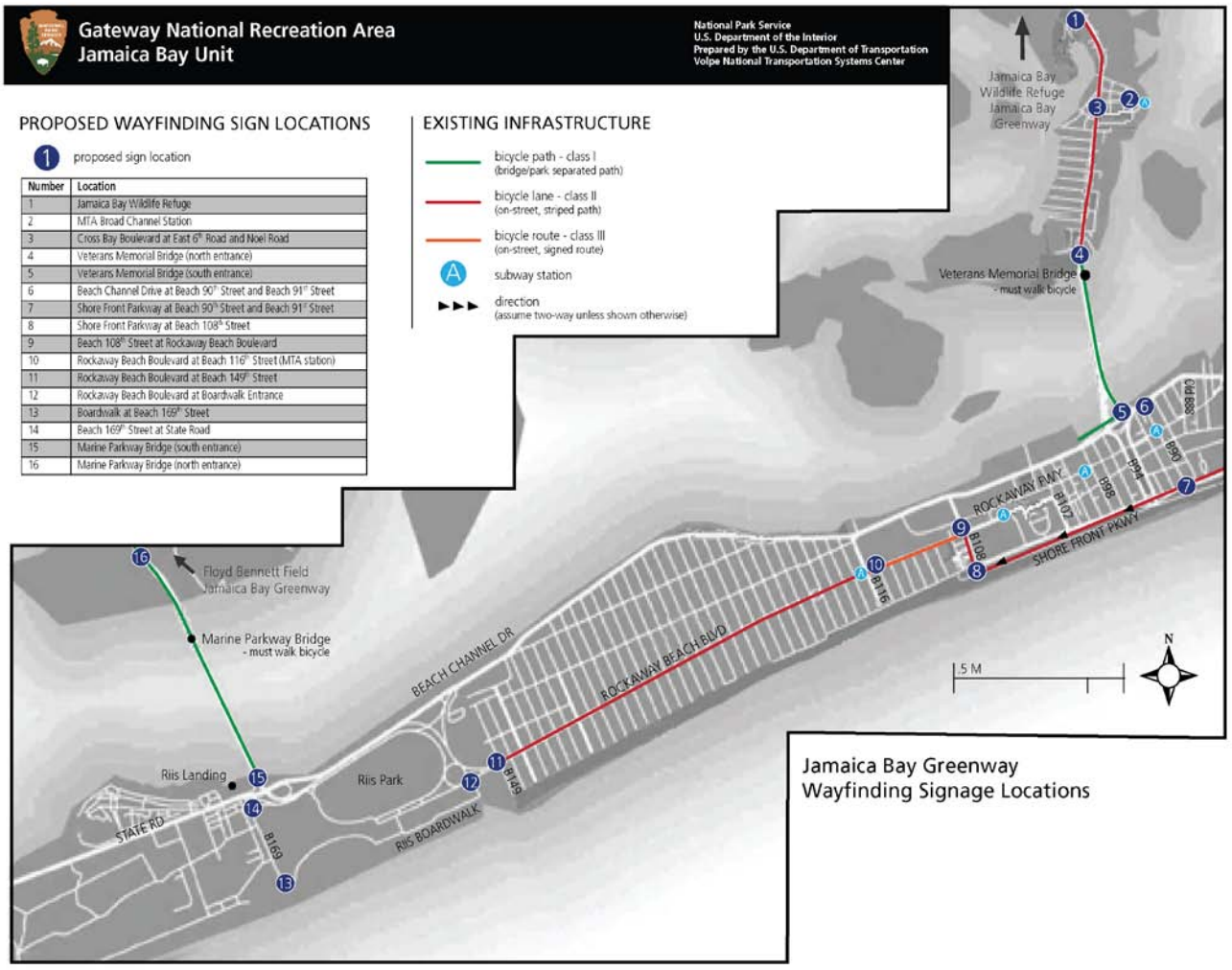


**Table 6 - Wayfinding signage locations**
Source: U.S. DOT, Volpe Center

| Number | Location |
|---|---|
| 1 | Jamaica Bay Wildlife Refuge |
| 2 | MTA Broad Channel Station |
| 3 | Cross Bay Boulevard at East 6th Road and Noel Road |
| 4 | Veterans Memorial Bridge (north entrance) |
| 5 | Veterans Memorial Bridge (south entrance) |
| 6 | Beach Channel Drive at Beach 90th Street and Beach 91st Street |
| 7 | Shore Front Parkway at Beach 90th Street and Beach 91st Street |
| 8 | Shore Front Parkway at Beach 108th Street |
| 9 | Beach 108th Street at Rockaway Beach Boulevard |
| 10 | Rockaway Beach Boulevard at Beach 116th Street (MTA station) |
| 11 | Rockaway Beach Boulevard at Beach 149th Street |
| 12 | Rockaway Beach Boulevard at Boardwalk Entrance |
| 13 | Boardwalk at Beach 169th Street |
| 14 | Beach 169th Street at State Road |
| 15 | Marine Parkway Bridge (south entrance) |
| 16 | Marine Parkway Bridge (north entrance) |

The city of Chicago's Bikeways Signage System, shown below in Figure 47, is a model for success that could be replicated in Jamaica Bay. The Chicago model incorporates the three "D's" -- Direction, Destination, and Distance -- and is also compliant with new standards established in the 2009 edition of the Manual on Uniform Traffic Control Devices (MUTCD)[24].

**Figure 47 - City of Chicago Bikeways Signage System**
Source: City of Chicago


The City of New York and NPS have both also established their own unique signage guidelines, and any interventions would have to be sensitive to the standards already in place. Continuity with existing signage elsewhere in New York City will help avoid confusion and will help brand the Jamaica Bay Greenway as a destination for cyclists from the entire region.

[24] MUTCD. http://mutcd.fhwa.dot.gov/pdfs/2009/part9.pdf. P. 799.

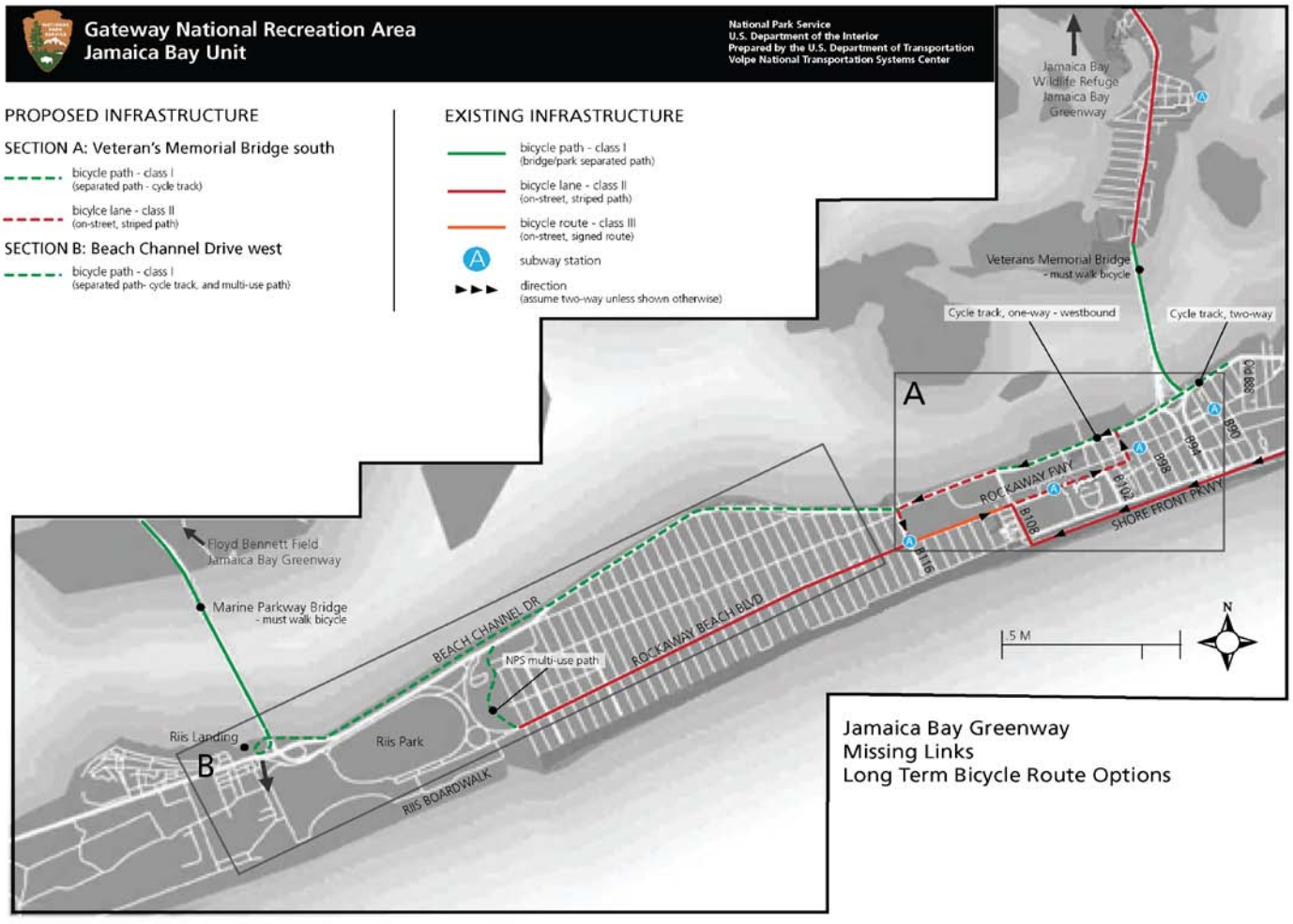
## Section 10: Long term interventions

### 10.1 Area/route introduction

The long term interventions for this area consider the stretch of BCD between the Marine Parkway Bridge and the Veterans Memorial Bridge, and further east to Old Beach 88th Street. The distance of BCD from the Marine Parkway Bridge to Old Beach 88th Street is approximately 4 miles. The northern section of the roadway from the base of the Marine Parkway Bridge to Beach 116th Street features no shore front development. From Beach 116th Street to the base of the Veterans Memorial Bridge, significant commercial, industrial, and institutional (namely Beach Channel High School) development is located on the north and south sides of the road. BCD is an essential component of a comprehensive, well-connected non-motorized network among Jamaica Bay Unit destinations.

Figure 48 illustrates the main route for the long term intervention along Beach Channel Drive from approximately Old Beach 88th Street to the Marine Parkway Bridge.

**Figure 48 – Long term bicycle route/intervention options**
Source: U.S. DOT, Volpe Center



## 10.2 Long term planning vision

This section describes a long term vision for enhancing the street design, streetscape, and adjacent water quality within Jamaica Bay, by proposing an innovative redesign and reconstruction of Beach Channel Drive to accommodate bicycle travel and to enhance the pedestrian experience. The long term planning concept for the redesign and reconstruction of Beach Channel Drive also considers "green" infrastructure elements.

The urban design of Beach Channel Drive should help define not only the circulation of vehicles, but also be representative of the neighborhood character and rich potential of the existing open space in the area. Jamaica Bay and its innate beauty amidst the urban environment is a key natural resource for the Rockaways. BCD should not act as a barrier that severs the communities from accessing the natural wonders of the Bay – including opportunities like fishing, jogging, walking, biking, exploring, or simply sitting and enjoying the views. The road currently operates as an urban highway, with divided and undivided segments. Crossing the street for bicyclists and pedestrians to the bayside is difficult and intimidating given traffic volumes and speeds.

A long term vision of BCD provides an opportunity to transform the road into an urban boulevard, while maintaining the existing level of transportation service and access to housing and commercial developments. The vision provides accommodations for non-motorized users, and an improved pedestrian realm with the inclusion of benches facing Jamaica Bay, pedestrian scale lighting, hanging planters, planted sidewalk medians and street trees. This may be done in conjunction with a needed rebuilding of the sea wall.

An additional element of the proposed redesign of Beach Channel Drive is to use urban design "tools" to maintain the openness and access to the bay edge between Beach 116th Street and the Marine Parkway Bridge. This area is currently free from roadside development.

Non-motorized infrastructure in the area would include the option to implement a physically separated bicycle path or cycle track along the entire stretch of BCD, where feasible, within the existing street right-of-way (ROW) limits. Enhanced signal timing along this stretch of BCD would be necessary to facilitate the safe crossing of bicyclists at intersecting streets, or to allow bicyclists to maneuver off of the path. Changes to signal phasing could include implementing an all-red phase at Beach 101st Street, Beach 102nd Street, Beach 108th Street, and Beach 116th Street to allow pedestrian/bicyclist "scatter" across the intersection to other streets/bicycle routes.

**What are cycle tracks?**

Cycle tracks are physically separated bicycle facilities that exclude motorized traffic. The separation from motorized traffic can be achieved with bollards, collapsible roadway delineator posts, planters, or by using a parking lane as a buffer. The essential characteristics that make cycle tracks different from traditional bicycle facilities like bicycle lanes, and bicycle paths are summarized below. Cycle tracks:

- Combine user experience of a separated path with the on-street infrastructure of a bike lane
- Provide space exclusively for bicycles
- Separate bicycle operations from vehicle travel lanes, parking lanes and sidewalks
- Incorporate design to accommodate one-way or two-way travel, and maintenance activities, like sweeping and snow removal

In general, cycle tracks are not recommended on roads where there are several crossing intersections, or where intersections are closely located. Cycle track facilities benefit from long blocks with signalized intersections, and minor intersecting streets because bicycle crossings can be controlled, and cross-traffic speeds are lower.

Basic design recommendations for cycle tracks are:

- 6.5-7 feet, one-way, 10 feet, two-way facility
- 2-3 feet for a physical separation or buffer zone
- 48" vertical height for a barrier separation

Figure 49 illustrates one example of a cycle track.

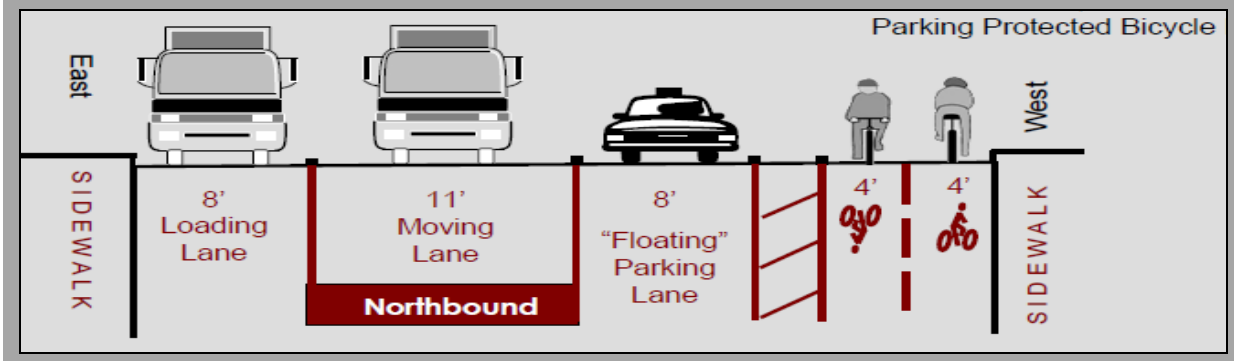
**Figure 49 - Cycle track example**
Source: Alta Planning and Design

**Cycle tracks in New York City**

New York City is a leader in implementing innovative cycle tracks, particularly where bicycle travel is already popular. Currently, there are cycle tracks in Manhattan on 8th Avenue and 9th Avenue and in Brooklyn on Tillary Street and Sands Street, with several other projects scheduled for installation during the summer of 2010.

The following is a cross-section (see Figure 50) width of the two-way parking protected bicycle lane installed on Kent Street in Brooklyn, where the two-way path is 8 feet wide with an approximate 3 foot buffer against the floating parking lane.

**Figure 50 - Kent Street parking protected bicycle lanes**
Source: NYCDOT




Motorized infrastructure in the area could be converted to be more in line with the characteristics of an urban boulevard. For example, the existing travel lanes, including intersection turning lanes, and parking where it is currently allowed could all be maintained to accommodate traffic demand and residential parking needs. However, travel lanes would be narrowed by approximately 1 foot from 12 feet to 11 feet, and parking stalls would be narrowed approximately the same, from 8 feet to 7 feet as a means to accommodate on-street bicycle facilities along BCD.

These design changes could maintain the existing capacity and vehicular throughput, and would help to reduce average speed along the road, enhancing the safety and experience of all users[25]. Where the cross section of Beach Channel Drive precludes a two-way cycle track only a one-way westbound facility is developed. Eastbound bicycles would be routed via Beach 116th Street and Rockaway Boulevard.

[25] Measured level-of-service (LOS) at the intersection of BCD with Beach 108th Street and Beach 122nd Street indicate LOS B and LOS A (averaged across all approaches), respectively. Since the volume/capacity ratios are low, and with no change to the lane configuration under the long-term vision for BCD, this service level will not be adversely affected by conversion of the road to an urban boulevard by narrowing the lane widths, incorporation of bicycle facility infrastructure, and enhancing the median. See *New York City Department of City Planning, Woodhaven – Cross Bay Bicycle Corridor Study*. (2009)

**Bicycle facility preferences**

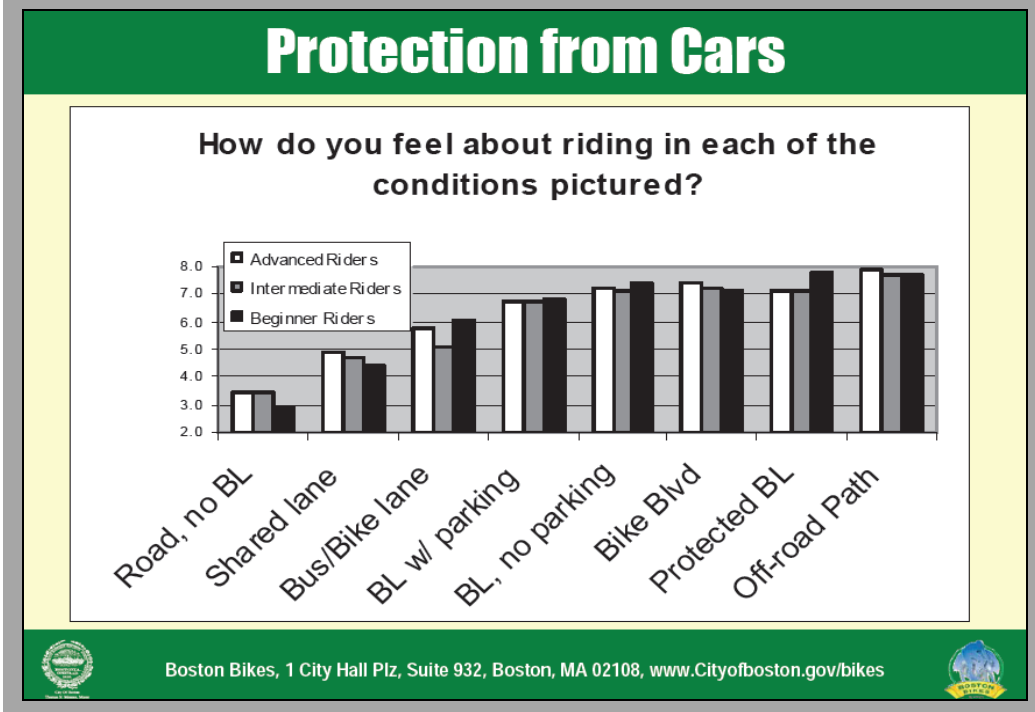
Research indicates that bicycle facilities encourage bicycling by both inexperienced and experienced riders.

A recent bicycle user survey initiated by the City of Boston found that regardless of experience level, users prefer bicycle facilities that designate specific road space to cyclists and provide maximum protection from adjacent traffic. Such facilities reduce traffic-related stress while negotiating the roadway network.

Figure 51 illustrates a sampling of bicycle facility user preferences in the City of Boston.

Portland State University conducted a study to determine how the built environment influences cycling behavior. Preliminary analysis indicated that half of all cycling trips occurred on dedicated bicycle infrastructure, despite the fact that bicycle infrastructure only accounts for 15 percent of the roadway network available to cyclists in the Portland area. Notably, bicycle boulevards account for less than 1 percent of total bicycle infrastructure in the region, yet 10 percent of area cycling occurred on these boulevards. (J. Dill, *Where do people Bicycle? The role of infrastructure in determining bicycle behavior*, May 16, 2008.)

**Figure 51 - Bicycle facility preferences in the City of Boston**
Source: City of Boston



**Porous concrete**

Porous concrete is used to mitigate storm water runoff issues and can also be used to construct bicycle facilities. The use of this material, given its unique texture and color difference, can help distinguish a cycle track or bicycle lane from the main road surface. Porous concrete allows storm runoff to percolate into the roadbed to infiltrate the subsurface soils over time. Figure 52 illustrates the implementation of porous concrete in the construction of bicycle lanes.

**Figure 52 - Examples of porous concrete bicycle lanes**
Source: Alta Planning and Design

The incorporation of green infrastructure in the area provides opportunities to mitigate the environmental degradation of Jamaica Bay due to storm water runoff from BCD by replacing the current hard surface median with a soft surface landscaped median engineered to act as a storm water infiltration system. This action serves multiple planning objectives, including enhanced landscape design and increased pedestrian safety (if made into pedestrian crossing refuges), articulating the characteristics of an urban boulevard and providing storm water management for Jamaica Bay. Redesign of the median would also allow re-allocation of road space to accommodate a physically separated bicycle path or cycle track along BCD. This bicycle pathway could be constructed with porous concrete that could also serve as a storm water infiltration system[26][27]. These design elements will help to mitigate the run-off of contaminated water into Jamaica Bay, and overloading waste water treatment facilities[28]. An added advantage of the use of porous concrete for the segment of Beach Channel Drive where a segregated cycle track is not feasible is that both the texture and color are differentiated from the adjacent asphalt travel lanes, further delineating road space for the operation of bicycles. The green soft-surface roadway median

[26] Personal communications 10/19/09, C. Tosomeen, P.E., Water Resources Engineer, City of Olympia, WA; C. Tosomeen, P.E. and Z. Lu, P.E., *Pervious Concrete Bicycle Lanes – Roadway Storm water Mitigation within the Right-of-Way*, ASCE Low Impact Development Storm water Conference, November 2008.
[27] Craig Tosomeen, P.E., City of Olympia, WA Public Works Water Resources.
[28] Local Law 71 (July 20, 1975) mandates development of a watershed protection plan for the watershed/sewer shed of Jamaica Bay. In 2007 NYC DEP issued the Jamaica Bay Watershed Protection Plan28 in conjunction with the Jamaica Bay Watershed Protection Plan Advisory Committee – Co-chaired by Doug Adamo of the National Park Service, and Brad Sewell of the Natural Resources Defense Council. One of many key findings and recommendations is to reduce storm water and CSO overflows to Jamaica Bay by creating natural areas adjacent to roadways, and implementing porous pavement technologies.
The long run vision for Beach Channel Drive is to (a) create an enlarged roadside pedestrian vegetated realm along the bay edge; (b) incorporate soft pervious surface, storm water detention median ('green' infrastructure); and (c) incorporate a segregated cycle track – where feasible – using porous concrete for the bicycle lane(s).

infrastructure could also provide a pedestrian refuge to facilitate safer crossing to the bayside of Beach Channel Drive.

**Section A: Veterans Memorial Bridge South**

Figure 53 shows a proposed routing of bicycles in the vicinity of the southern end of the Veterans Memorial Bridge.

**Figure 53 - Section A: Veterans Memorial Bridge South route**
Source: U.S. DOT, Volpe Center


**Beach Channel Drive: east of Veterans Memorial Bridge**
*Cycle track, one-way or two- way*

**Proposal:** Two-way multi-use path adjacent to BCD from the Veterans Memorial Bridge exit to Beach 91st Street, intersecting with a signalized crossing at Beach 91st Street to facilitate travel south. The path on BCD may continue further east.

**Pros:**

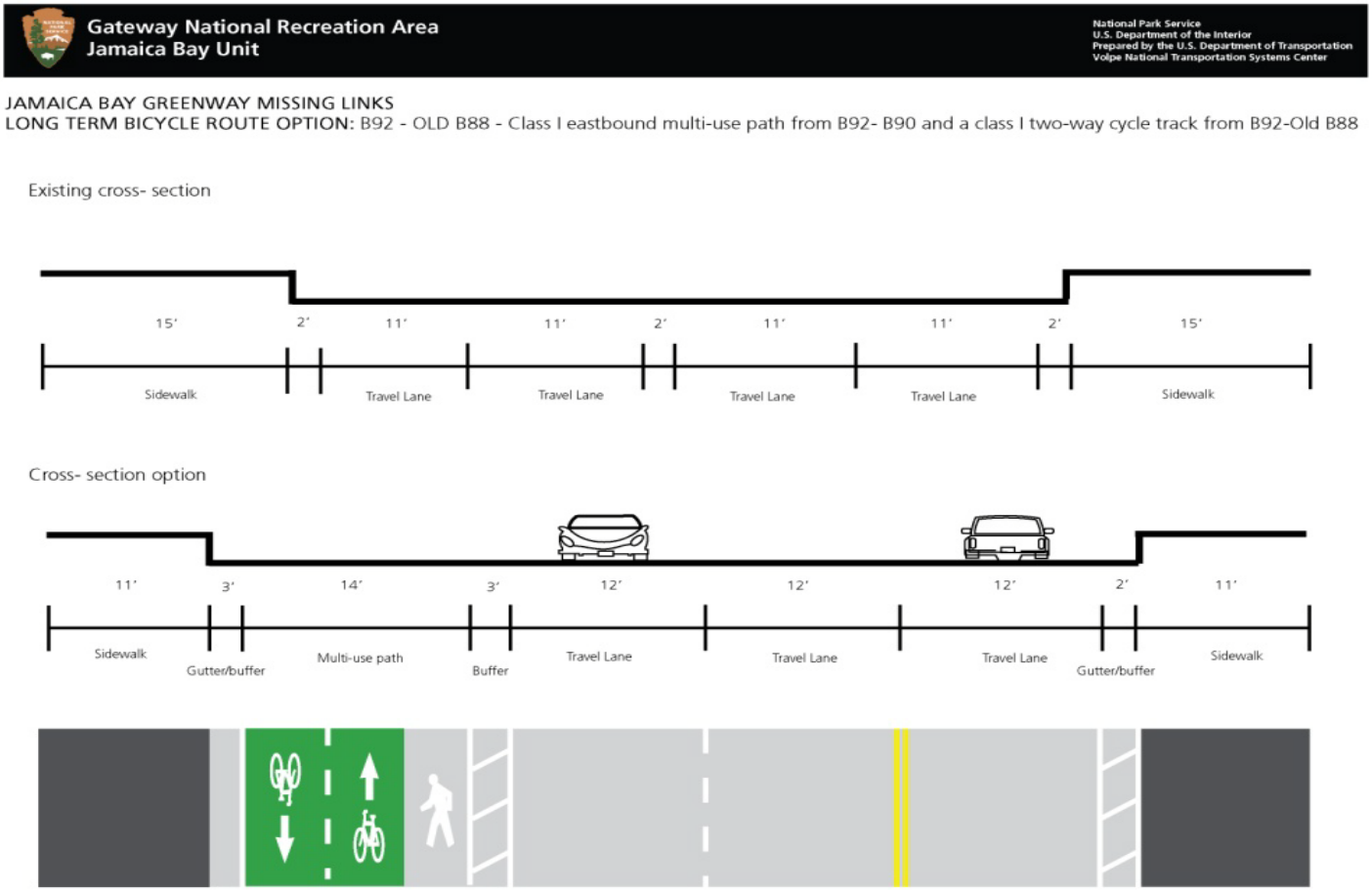
- Improves access to Veterans Memorial Bridge.
- Utilizes existing crosswalk at Beach 91st Street.

**Cons:**

- Physically separated pathway may be infeasible east of Beach 92nd Street.

Figure 54 illustrates the proposed cross section for Beach Channel Drive using existing right of way footprint in the area.

**Figure 54 - Long term bicycle route option: east of Veterans Memorial Bridge**
Source: U.S. DOT, Volpe Center




**Beach Channel Drive: Beach 98th Street-Beach 108th Street, westbound**
*Cycle track, one-way*

**Proposal:** Enhance esplanade path to facilitate bicycle travel from the Veterans Memorial Bridge west to Beach 98th Street. Create a one-way cycle track for bicycles heading westbound from Beach 98th Street to Beach 108th Street, with a buffer zone consisting of flexi-post bollards.

**Pros:**

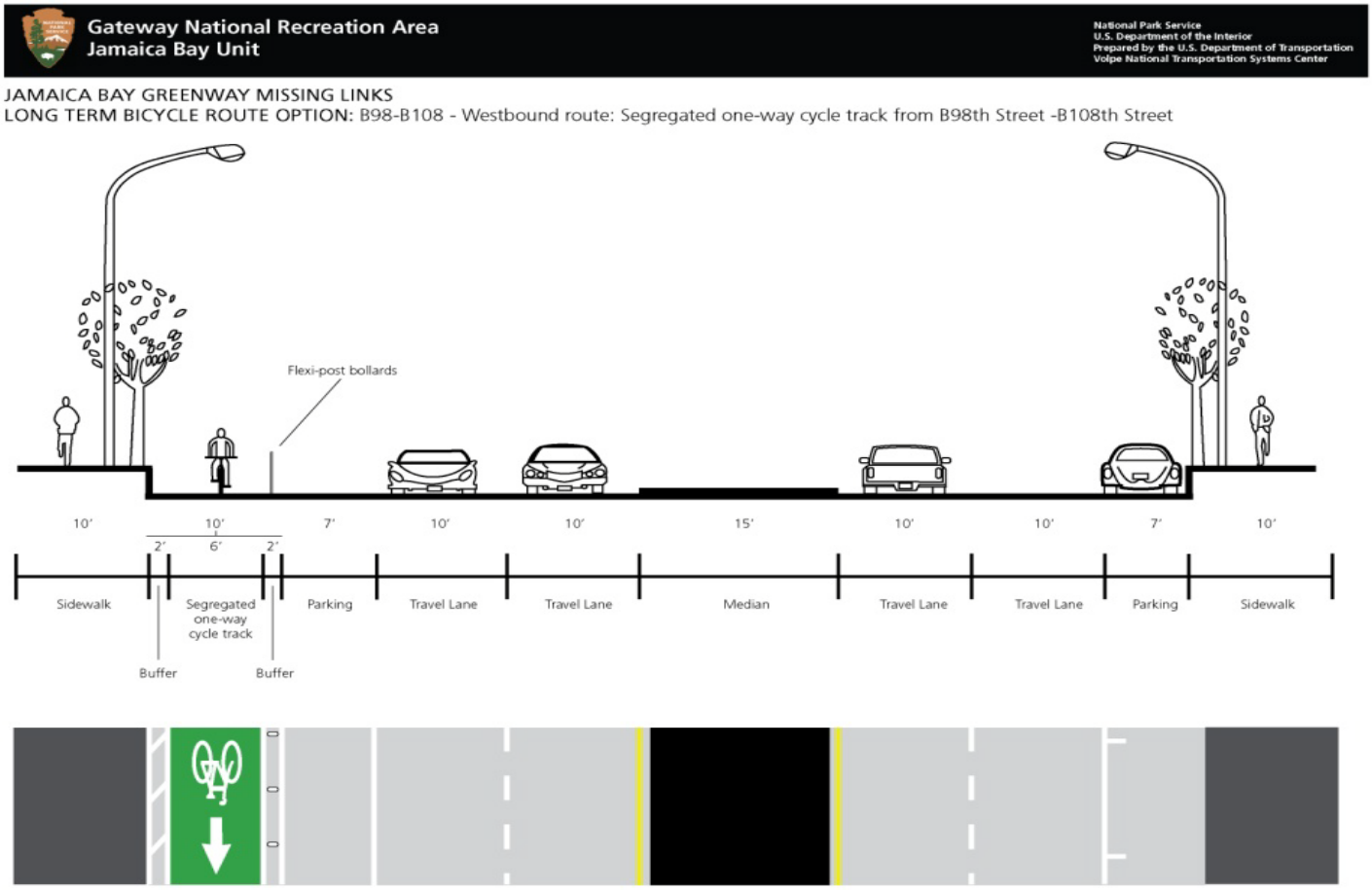
- Mitigates user conflicts along the esplanade.
- Allows bicyclists and pedestrians to more easily enjoy the views of Jamaica Bay.
- There are very few curb cuts along BCD in this area, allowing for physical separation at most points.
- Cycle track will bring bicycles off sidewalks and also away from the high speed traffic on BCD in vicinity of the Bridge.
- Buffer zone can consist of a flexi-post bollard system.

**Cons:**

- Because only a one-way cycle track is feasible between Beach 98th Street and Beach 108th Street, eastbound traffic will be routed differently (see below).

Figure 55 below illustrates the concept.

**Figure 55 - Long term bicycle route option: Beach 98th Street-Beach 108th Street, westbound**
Source: U.S. DOT, Volpe Center



Several snapshots based on spatial sampling of the street configuration and roadside developments are illustrated in Figure 56 below for this segment of BCD.

**Figure 56 - Beach 98th Street-Beach 108th Street photo samples**
Sources: Google, 2009, U.S. DOT, Volpe Center

**Beach Channel Drive: Beach 108th Street-Beach 116th Street, westbound**
*Class II bicycle lane*

**Proposal:** Westbound bicyclists transition to an on-street, striped bicycle lane.

**Pros:**

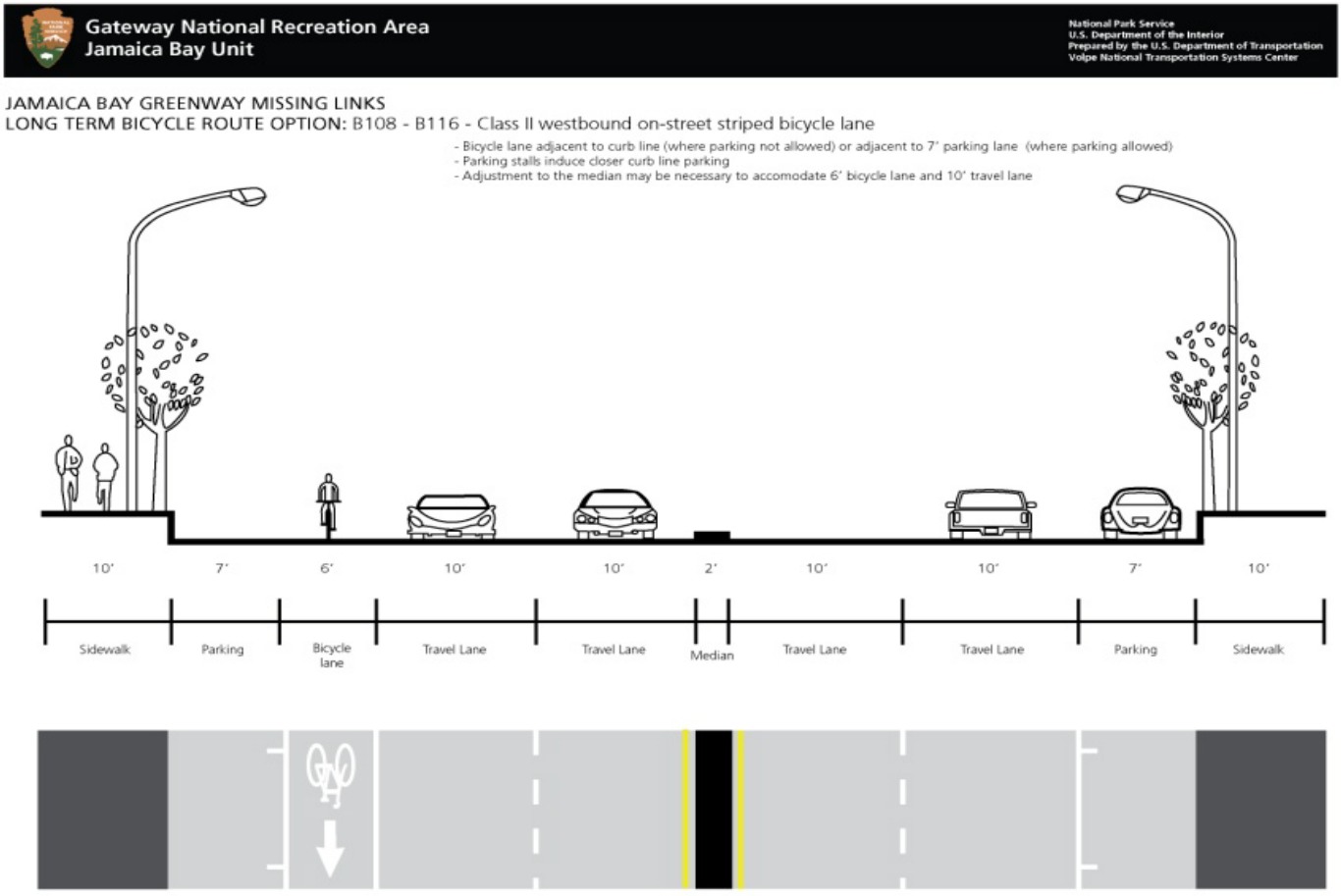
- Traffic lights and commercial developments are abundant in this section, which slows down vehicles with which bicyclists will share the road.

**Cons:**

- Intense land use and high density of curb cuts precludes a fully segregated cycle track.
- BCD is too narrow in this segment to accommodate a bicycle lane in both directions corresponding to AASHTO guidelines without reconfiguring travel and/or parking lanes.
- Eastbound traffic will be routed differently (see below).

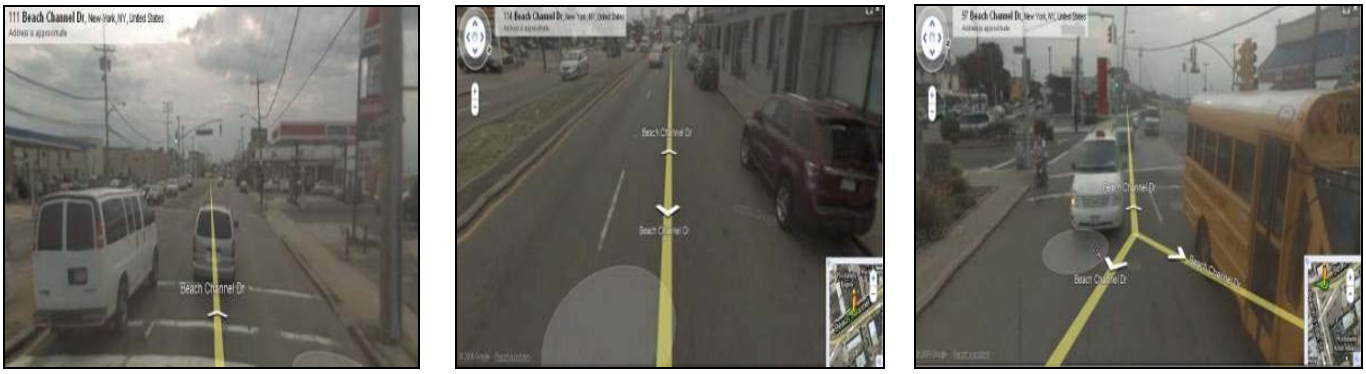
Figure 57 below illustrates the concept.

**Figure 57 - Long term bicycle route option: Beach 108th Street-Beach 116th Street, westbound**
Source: U.S. DOT, Volpe Center



Several snapshots based on random spatial sampling of the street configuration and roadside developments are illustrated in Figure 58 below for this segment of BCD.

**Figure 58 - Beach 108th Street-Beach 116th Street photo samples**
Sources: Google, 2009, U.S. DOT, Volpe Center



**Beach Channel Drive: Beach 116th Street-Veterans Memorial Bridge, eastbound**
*Class II bicycle lane and Class III signed route with shared road markings*

**Proposal:** Eastbound cyclists exit BCD heading south along Beach 116th Street to Rockaway Beach Boulevard, where they will proceed east to Beach 102nd Street, and turn back north to BCD, and then east for one block to the crosswalk at Beach 101st Street. This section includes both Class II striped bicycle lanes and Class III facilities with signage and "sharrow" markings.

**Pros:**

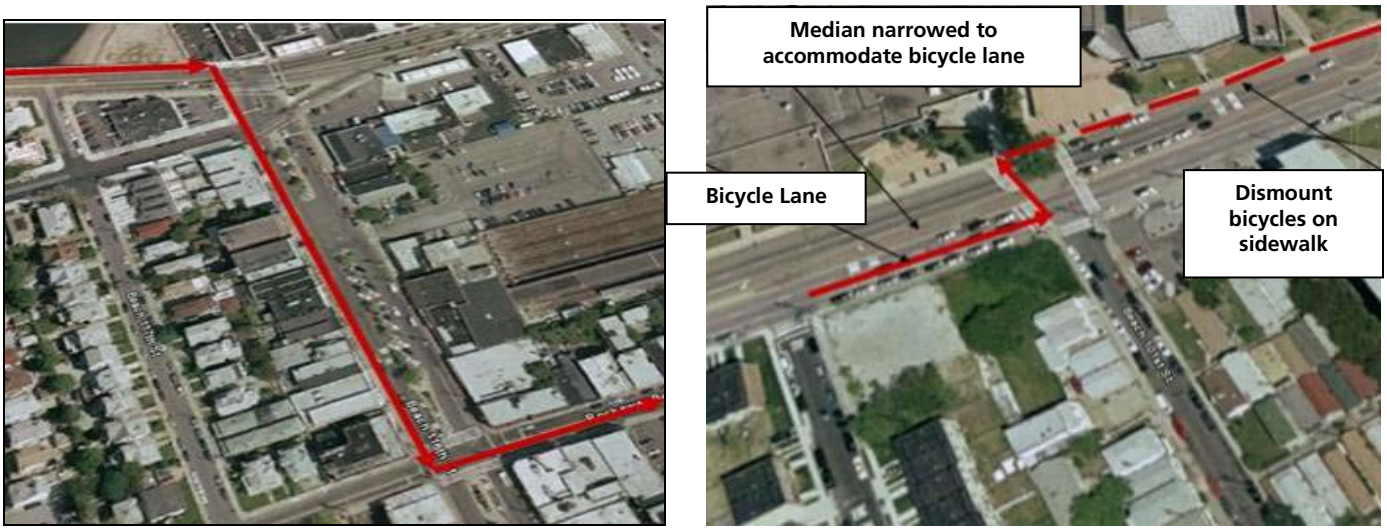
- Provides access to the Beach 116th Street commercial district, as well as the bicycle-friendly MTA Rockaway Park-Beach 116th Street station at the terminus of the "A" line.
- Returns eastbound cyclists to the Esplanade near the Veterans Memorial Bridge, with its views of Jamaica Bay and safe bicycling environment.
- Utilizes existing Class II and Class III facilities.

**Cons:**

- Eastbound bicyclists are forced off of BCD for fourteen blocks because BCD cannot accommodate a bicycle lane in each direction through this section.
- Bicyclists must cross BCD at Beach 101st Street, three blocks shy of the Esplanade, because the geometry of the ramp off of the Veterans Memorial Bridge would interfere with a new crosswalk at the terminus of the Esplanade at Beach 98th Street.

The median is quite wide at the block of BCD between Beach 102nd Street and Beach 101st Street, and can be narrowed to accommodate a striped bicycle lane in the eastbound direction (see illustration in Figure 59 below).

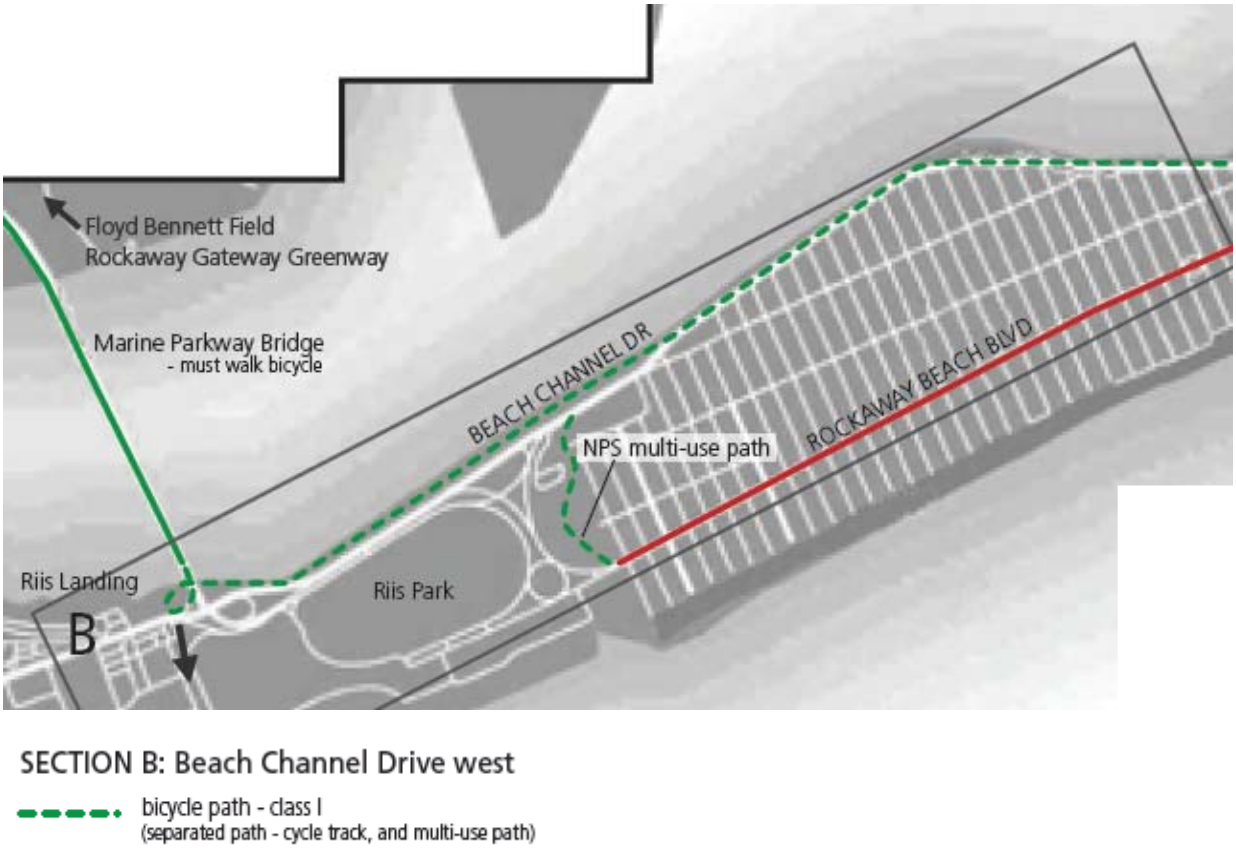
**Figure 59 - Beach 116th Street-Veterans Memorial Bridge route**
Sources: Google, 2009, U.S. DOT, Volpe Center



### Section B: Beach Channel Drive West

Figure 60 shows a long term vision for the routing of bicycles towards the west end of Beach Channel Drive, near Jacob Riis Park and the Marine Parkway Bridge.

**Figure 60 - Section B: Beach Channel Drive West route**
Source: U.S. DOT, Volpe Center




### Beach Channel Drive: Beach 116th Street-Jacob Riis Park
*Cycle track, two-way*

**Proposal:** Develop a two-way cycle track adjacent to BCD between Beach 116th Street and Beach 143rd Street. West of Beach 143rd Street, transition to the off-street esplanade to the Marine Parkway Bridge and other points west and north.

**Pros:**

- Complete physical separation using 2' x 25' curbed islands with planters on 10' gap spacing.
- High visibility along this stretch between bicyclists and motorists.
- There are no curb cuts along this segment, thus negating vehicular turning movements or conflicts.
- Signal timing at the intersection of BCD and Beach 116th Street could include an all-red phase to allow bicycle/pedestrian "scatter" across the intersection.

**Cons:**

- Westbound route to Jacob Riis Park along BCD is slightly circuitous.

Figure 61 illustrates this concept.

**Figure 61 - Long term bicycle route option: Beach 116th Street-Jacob Riis Park**
Source: U.S. DOT, Volpe Center

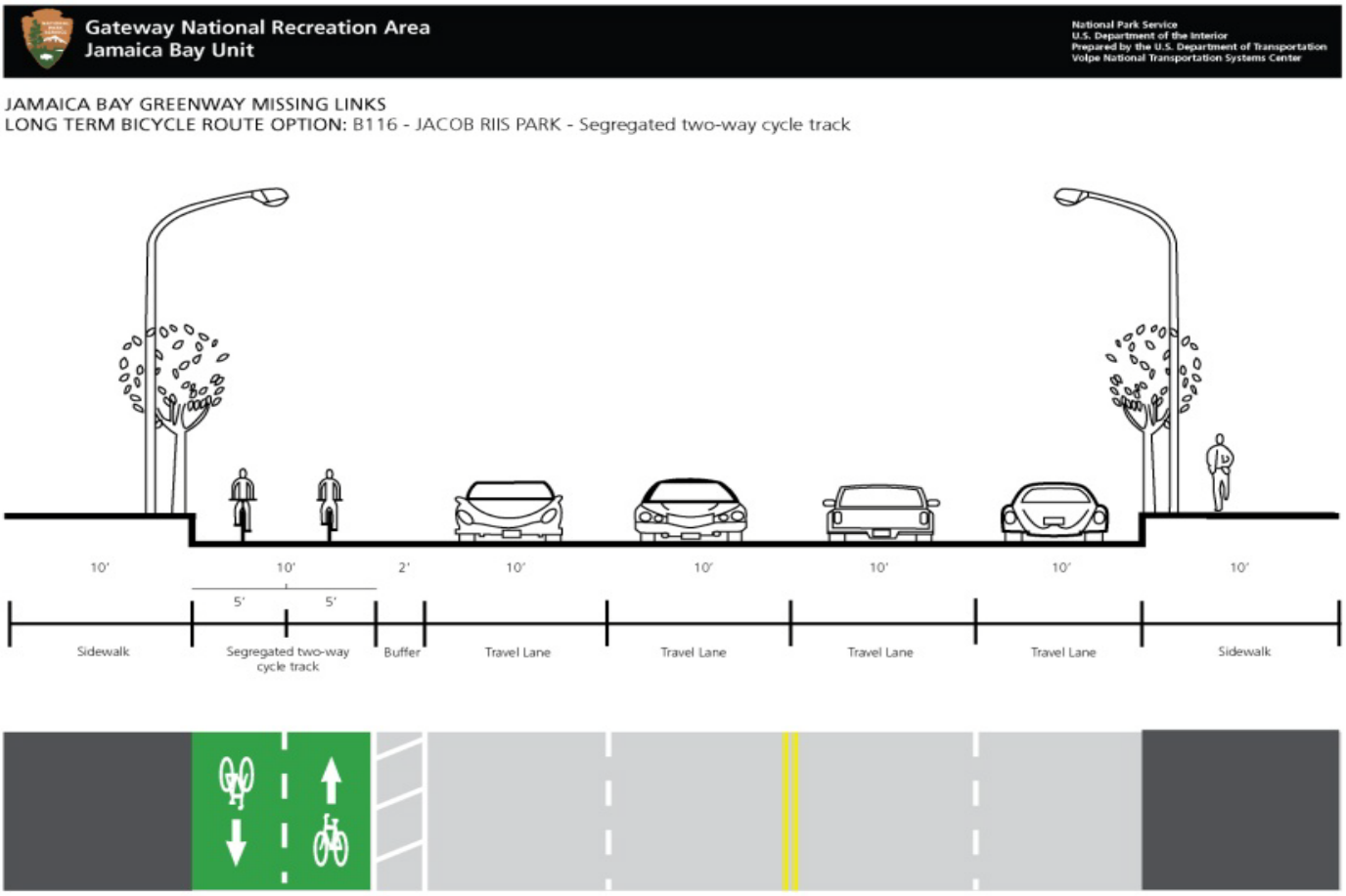



Figure 58 illustrates two options for a physical separation buffer for a bicycle lane. A vertical height barrier is achieved with landscaped planters when the cycle track is adjacent to a travel lane.

**Figure 62 - Bicycle lane physical separation options**
Source: SavedByBikes[29], Economy League of Greater Philadelphia[30]

Several snapshots based on random spatial sampling of the street configuration and roadside developments are illustrated in Figure 63 below for this segment of BCD.

**Figure 63 - Beach 116th Street-Jacob Riis Park photo samples**
Sources: Google, U.S. DOT, Volpe Center




[29] "Saved By Bikes" blog. http://savedbybikes.com/blog/wp-content/uploads/2009/10/nynylanes-400x266.jpg. Accessed May 19, 2010.
[30] Economy League of Greater Philadelphia. http://economyleague.org/files/9th-avenue-bike-lane-manhattan.jpg. Accessed May 19, 2010.

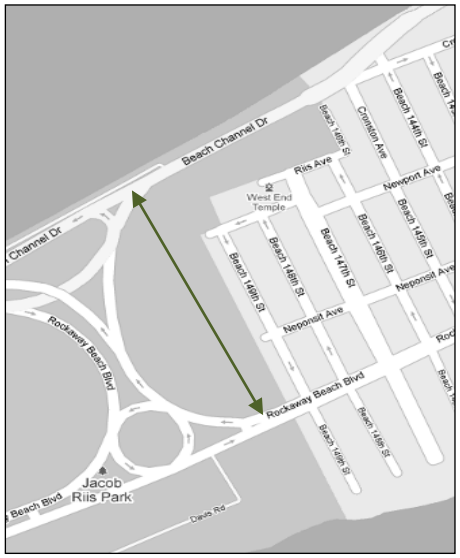
**NPS land east of Riis Park**
*Multi-use bicycle and pedestrian path*

At the western end of Rockaway Beach Boulevard near Riis Park, pedestrian and bicyclists may continue traveling west to enter Jacob Riis Park via the Boardwalk and other inland pathways, but have limited options for safely traveling north. Northbound travel on Rockaway Beach Boulevard towards Beach Channel Drive for bicyclists or pedestrians is undesirable due to the high automobile speeds and lack of bicycle lanes or sidewalks.

The land located directly northwest of Rockaway Beach Boulevard at Beach 149th Street is owned and maintained by NPS. The area is used intermittently as a baseball field and as a de-facto walking trail between Rockaway Beach Boulevard and Beach Channel Drive.

NPS has expressed interest in creating a multi-use pathway to provide a safe connection to Beach Channel Drive and the existing multi-use path along the shorefront. The alignment of this path is shown in Figure 64, and could coincide with a signalized pedestrian crossing to create a seamless, safe, convenient, and car-free pedestrian and bicycle north-south route.

**Figure 64 - Multi-use bicycle and pedestrian path route**
Source: Google, 2009, U.S. DOT, Volpe Center




**Pros:**

- Relieves bicycle congestion in the area of Jacob Riis Park.
- Connects Jacob Riis Park to Beach Channel Drive.
- Avoids circuitous route via State Road and Beach 169th Street for thru traffic between Marine Parkway Bridge and points east.

**Cons:**

- Potential opposition from abutters.
- Environmental impact must be assessed.

## Section 11: Funding sources

This section identifies various sources of federal funding that may be available to NPS and its partners (including city agencies) if and when they seek to implement the interventions described in this study. This includes funding specifically targeted at alternative transportation in national parks, as well as other sources of funding tied to the environmental benefits of these options.

### *NPS Park Roads and Parkways (PRP) Program*

NPS jointly administers the PRP Program along with the U.S. DOT Office of Federal Lands Highway (FLH), as part of the Federal Lands Highway Program (FLHP). A key component of the PRP Program is a category of funding, Category III, that allows for the planning and implementation of alternative transportation systems.

More information is available at: http://flh.fhwa.dot.gov/programs/prp/.

### *Paul S. Sarbanes Transit in Parks (TRIP) Program*

The TRIP Program funds capital and planning expenses for alternative transportation systems in national parks and public lands. The program is administered by the Federal Transit Administration (FTA), in partnership with the U.S. Department of Interior (DOI) and the U.S. Department of Agriculture Forest Service (USFS). TRIP funds may be sought for implementation of bicycle and pedestrian infrastructure in and around NPS sites at Jamaica Bay.

More information is available at: http://www.fta.dot.gov/funding/grants/grants_financing_6106.html.

### *Federal Highway Administration (FHWA) Congestion Mitigation and Air Quality (CMAQ) Improvement Program*

The CMAQ Program provides funding for capital projects and programs in air quality nonattainment and maintenance areas that reduce transportation-related emissions. Gateway qualifies as such an area of nonattainment, and the bicycle and pedestrian interventions proposed in this study would reduce emissions.

More information is available at: http://www.fhwa.dot.gov/environment/cmaqpgs/.

### *U.S. EPA Nonpoint Source Management and Targeted Watersheds Grant Programs*

These grant programs provide for the protection of water resources in watersheds. These funds may be able to be combined with efforts to bolster the seawall along Jamaica Bay and allow for a much safer and pleasant bicycling experience along Beach Channel Drive.

More information is available at: http://www.epa.gov/nps/cwact.html, or http://www.epa.gov/twg/.

### *U.S. Army Corps of Engineers (USACE) Aquatic Ecosystem Restoration Program*

This program enables USACE to restore degraded aquatic ecosystems if doing so will improve environmental quality, is in the public interest, and is cost-effective. The proposed long term interventions along Beach Channel Drive may have ancillary benefits for the aquatic ecosystem in Jamaica Bay, thus making the project eligible for funds under this program.

More information is available at: http://www.lrb.usace.army.mil/missions/SECTION 206 FLYER 07_2006 12.doc.

## Section 12: Next steps

This section outlines a series of "next steps" to achieve the goals outlined in this report. They are categorized by the stakeholders that should lead each respective effort.

**NPS Gateway staff:**

*Policy and planning*

- Align the goals and outcomes of this study with the ongoing Gateway National Recreation Area General Management Plan (GMP) effort.
- Formally amend the Park Program Manual for use of the boardwalk at Riis Park to articulate the conditions under which bicyclists may ride on the boardwalk.
- Develop a regulatory signage plan with a law enforcement mechanism (e.g. specification of random bicycle patrols by rangers). Implementation of signs, compliant with NPS sign standards, would be at all relevant entry points to the boardwalk off of the street and path network.
- Collect data on visitation and other quantifiable factors in 2010 and beyond.
- Develop a survey to distribute to Jamaica Bay Unit visitors inquiring about their mode of access and travel times to Gateway, and also to gauge their interest in non-motorized alternatives.
- Continue to cultivate relationships with governmental agencies responsible for implementing changes on non-NPS property in Broad Channel and the Rockaways.
- Evaluate options to create a network of completely separated bike paths on NPS property only, in such areas as Floyd Bennett Field and between Jacob Riis Park and Fort Tilden.
- Consider a pilot "bike share" program where visitors can rent bicycles to travel between NPS Jamaica Bay Unit sites.
- Engage with the Aviator Sports and Events Center, a private concessionaire at Floyd Bennett Field that rents bicycles, to discuss joint marketing and outreach opportunities.

*Infrastructure-related*

- Install bicycle racks at all NPS Jamaica Bay Unit sites.
- Revise the signage on Beach 169th Street to allow entry of bicycles in addition to "official vehicles."
- Organize a technical advisory committee (TAC) of both NPS and non-NPS subject matter experts to work with an Architecture/Engineering (A/E) contractor to develop a detailed plan and preliminary engineering for the proposed multi-use path across NPS-owned lands (described in Section 10). Detailed planning and preliminary engineering would include resource inventory and associated field site work (e.g. soil borings) to determine technical feasibility, gross environmental impact and best alignment.

**NYCDOT:**

- Ensure that the NPS bicycle policy on NPS land is accurately reflected in the New York City Cycling Map.
- Evaluate the feasibility and potential impacts of converting the "hashmarked" buffer along the westbound portion of Shore Front Parkway into a Class II bicycle lane.
- Consider applications for NPS Category III and TRIP funding for four implementation projects identified in this study. These are detailed in Appendix C.

**NYCDCP:**

- Support, in particular, the sections of this study that align with recommendations from the NYCDCP Woodhaven Cross Bay Bicycle Corridor Study.
- Incorporate recommendations from study into the NYCDCP New Waterfront Revitalization Plan.

**NYC Parks:**

- Promote the Greenway connections to the NYC park system.

**MTA:**

- Implement signage and wayfinding on MTA buses and subways, and in and around MTA facilities. Consider development of a joint MTA/NPS tri-fold brochure, outlining transportation options to NPS sites, to be distributed at both MTA and NPS visitor centers and information booths.

**RPA**:

- Build a coalition of local advocates, similar to the effort made on the Brooklyn Greenway Initiative.
- Convene meetings with key stakeholders to market the Jamaica Bay Greenway as vital to the region's long term sustainability goals.

**All New York City Agencies:**

- Incorporate the results of this report into both short- and long-range planning efforts in the area.
- Support an official name change to the Jamaica Bay Greenway in order to account more effectively for the diversity of neighborhoods along the Greenway's path.
- Engage in a process to educate the public about the goals of this study and to encourage their support. This can be achieved by attending the monthly meetings for each of the four local community boards impacted by the study, as well as bicycle advocates and other local advocacy groups.

## Appendix A: MTA service frequencies

**Table A-1. Q22 and Q35 bus approximate weekend service frequency, minutes**
Source: MTA New York City Transit

| Q22 bus | | | Q35 bus | | |
|---|---|---|---|---|---|
| 5:30 am – 10:00 am | 10:00 am – 7:00 pm | 7:00 pm – 1:00 am | 2:30 am – 8:30 am | 8:30 am – 6:00 pm | 6:00 pm – 12:00 am |
| 15-20 | 9-11 | 15-30 | 30 | 12-15 | 15-30 |

**Table A-2. Q22 and Q35 bus approximate weekday service frequency, minutes**
Source: MTA New York City Transit

| Q22 bus | | | Q35 bus | | |
|---|---|---|---|---|---|
| 5:30 am – 7:00 am | 7:00 am – 7:00 pm | 7:00 pm – 1:00 am | 12:30 am – 6:00 am | 6:00 am – 8:00 pm | 8:00 pm – 12:30 am |
| 15-20 | 10 | 15-30 | 30 | 10-15 | 20-30 |

**Table A-3. Q21 and Q53 bus approximate weekend service frequency, minutes**
Source: MTA New York City Transit

| Q21 | Q53 | | | | | |
|---|---|---|---|---|---|---|
| Saturday and Sunday | Saturday | | | Sunday | | |
| 8:00 am – 10:30 pm | 6:30 am – 8:00 am | 8:00 am – 11:00 pm | 11:00 pm – 1:00 am | 6:30 am – 9:00 am | 9:00 am – 8:45 pm | 9:00 pm – 1:00 am |
| 30 | 30 | 10-15 | 20 | 15-20 | 10 | 15-20 |

**Table A-4. Q21 and Q53 bus approximate weekday service frequency, minutes**
Source: MTA New York City Transit

| Q21 | Q53 | |
|---|---|---|
| Weekday | Weekday | |
| 6:30 am – 10:00 pm | 6:00 am – 10:00 pm | 10:00 pm – 12:00 am |
| 30 | 8-15 | 20 |

**Table A-5. A train and S train, approximate weekend daytime service frequency, minutes**
Source: MTA New York City Transit

| A train Manhattan to Broad Channel, Queens | S train Broad Channel to Rockaway Park–Beach 116 St | |
|---|---|---|
| Saturday and Sunday | Saturday | Sunday |
| 16-20 | 12-21 | 10-24 |

**Table A-6. A train and S train, approximate weekday daytime service frequency, minutes**
Source: MTA New York City Transit

| A train Manhattan to Broad Channel, Queens | S train Broad Channel to Rockaway Park–Beach 116 St | |
|---|---|---|
| Weekday | Weekday 6:30 am – 9:30 pm | Weekday 9:30 pm – 6:30 am |
| 10-30 | 6-10 | 20 |

## Appendix B: Beach Channel Drive characteristics

**Table B-1. Beach Channel Drive (BCD) traffic volumes (average 15-minute volumes)**

| Observation Point | AM-EB | AM-WB | Midday-EB | Midday-WB | PM-EB | PM-WB |
|---|---|---|---|---|---|---|
| Beach Channel Drive at Beach 108th street | 569 | 624 | 419 | 437 | 531 | 698 |
| Beach Channel drive at Beach 122nd Street | 498 | 678 | 408 | 422 | 590 | 606 |
| Beach Channel Drive at Beach 134th Street | 373 | 725 | 334 | 378 | 559 | 494 |

**Table B-2. Cross section and lane configuration data**

| Street | Block (From/To street) | Width | Traffic direction | Number of travel lanes per direction of traffic | Width of median or traffic island, if any |
|---|---|---|---|---|---|
| BCD | Beach 90th Street to Beach 92nd Street | 52 ft. | 2-way | 2 WB, 1 EB | |
| BCD | Beach 92nd street to Beach 96th Street | 52 ft. | 2-way | 2 WB, 1 EB | 6 ft. |
| BCD | Beach 96th Street to Beach 97th Street | 70 ft. | 2-way | 2 WB, 3 EB | 6 ft. |
| BCD | Beach 97th Street to Beach 98Th Street | 68 ft. | 2-way | 2 WB, 3 EB | 6 ft. |
| BCD | Beach 98th Street to Beach 99th Street | 80 ft. | 2-way | 2 WB, 2 EB | 6-10 ft. gradually, then merges with the 17 ft. median |

| | | | | | |
|---|---|---|---|---|---|
| BCD | Beach 99th Street to Beach 100th Street | 80 ft. | 2-way | 3 WB, 3 EB | 17 ft. |
| BCD | Beach 100th Street to Beach 101st Street | 80 ft. | 2-way | 2 WB, 2 EB, plus I left-turn bay for WB traffic at B 101st Street | 6 ft. |
| BCD | Beach 101st Street to Beach 102nd Street | 80 ft. | 2-way | 2 WB, 2 EB | 17 ft. |
| BCD | Beach 102nd Street to Seaside Avenue | 80 ft. | 2-way | 2 WB, 2 EB, plus 1 left turn bay for WB traffic at Seaside Avenue | 6 ft. |
| BCD | Seaside Avenue to Beach 104th Street | 80 ft. | 2-way | 2 WB, 2 EB, 1 left turn bay for EB traffic at Seaside Avenue | 6-10 ft. gradually, the merges with the 17 ft. median |
| BCD | Beach 104th Street to Beach 108th Street | 80 ft., narrows to 73.5 ft. near B 108th Street | 2-way | 2 WB, 2 EB | 17ft., narrows gradually to 6 ft. near B 108th Street |
| BCD | Beach 108th Street to Rockaway Freeway | 70 ft., widens to 75 ft. near Rockaway Freeway | 2-way | 2 WB, 2 EB | 6 ft., widens to 12.5 ft. near Rockaway Freeway |
| BCD | Rockaway Freeway to Beach 116th Street | 80 ft. | 2-way | 2 WB, 2 EB, 1 left turn bay for WB traffic at parking lot entrance across shopping strip | 17 ft. median, narrows to 6 ft. at or near intersections |
| BCD | Beach 116th Street to Beach 129th Street | 52 frt. | 2 –way | 2 WB, 2 EB | No medians, ends at B 116th Street |
| BCD | Beach 129th Street to Beach 145th Street | 52 ft. | 2-way | 2 WB, 2 EB | No medians |

## Appendix C: Project Management Information System (PMIS) project synopses

This appendix identifies four projects for potential inclusion in the NPS Project Management Information System (PMIS).

### Implementation Project #1: State Road mid-block crossing

A critical element in the proposed short-term and long term routing for bicycle access to connect Jacob Riis Park to the Jamaica Bay Wildlife Refuge and to the Jamaica Bay Greenway that encircles Jamaica Bay is a safe pedestrian/bicycle crossing west of the Marine Parkway Bridge across State Road to Beach 169th Street.

This implementation project would accomplish the following:

- Conduct site survey work and develop construction drawings and specifications for a new crosswalk and protected curbed pedestrian refuge median (with MUTCD-compliant signage) across State Road in the proximity of Beach 169th Street.
- Construct the crosswalk and protected pedestrian curbed refuge median (with MUTCD-compliant signage).
- Construction management of the same.

Estimated Cost:

| | | |
|---|---|---|
| (a) | Site survey and design work: | $30K-$45K |
| (b) | Construction[31]: | $30K |
| (c) | Construction management: | $10K |
| | Total: | $70K-$85K |

### Implementation Project #2: Wayfinding signage

A signage and wayfinding system throughout the Rockaway and Broad Channel areas would provide destination, direction and distance information to key attractions (e.g., Riis Park, Jamaica Bay Wildlife Refuge, Floyd Bennett Field, the Jamaica Bay Greenway, the MTA "A" Line subway stations at Broad Channel and Rockaway Park-Beach 116th Street).

This implementation project would accomplish the following:

- Adoption of appropriate design standards for bicycle-scale wayfinding signage.
- Development of a detailed plan for location placement.
- Fabrication and installation of signs in accordance with the detailed plan.

Estimated Cost[32]:

| | | |
|---|---|---|
| (a) | Develop detailed plan (and design standards): | $40K |
| (b) | Fabrication and Installation: | ~$10K |
| | Total: | $50K |

[31] Rough estimate based on data from Walkinginfo.org at http://www.walkinginfo.org/engineering/crossings-enhancements.cfm. Accessed May 27, 2010.

[32] Rough estimate based on data provided in M. Farrell, *Best Practices in Bicycle and Pedestrian Wayfinding in the Washington Region*, Draft, May 15, 2007.

### Implementation Project #3: Bicycle infrastructure installation

Several miles of Class II striped on-road bicycle lanes throughout the Rockaways, and the application of shared lane markings in a specific section of Broad Channel, will provide bicycle connections that facilitate non-motorized visitation to key attractions at the Jamaica Bay Unit and enhance the safety and comfort of bicyclists.

This implementation project would accomplish the following:

- Conduct site survey work and develop construction drawings and specifications for the striping of new on-street bicycle lanes along specific streets in the Rockaways as proposed in this study, or on the roadway alignment deemed feasible by NYCDOT.
- Conduct site survey work and develop construction drawings and specifications for the application of shared lane markings on East 6th Road and Noel Road in the Broad Channel neighborhood, or on the roadway alignment deemed feasible by NYCDOT.

Estimated Cost:

| | | |
|---|---|---|
| (a) | Site survey and design work: | $30K-$45K |
| (b) | Construction of 5 miles of striped bicycle lanes ($27K per mile[33]): | $135K |
| (c) | Application of 4 shared lane markings ($100 each[34]): | $400 |
| (d) | Construction Management: | $10K |
| | Total: | $175K-$190K |

### Implementation Project #4: Beach Channel Drive mid-block crossing

A mid-block crossing on Beach Channel Drive would facilitate non-motorized access to existing walking facilities on the Jamaica Bay side of Beach Channel Drive in the Rockaways. This signalized crossing would enhance the safety for pedestrians and bicyclists (who would be required to dismount) traveling to Jacob Riis Park, the Marine Parkway Bridge, Floyd Bennett Field, or other destinations.

This implementation project would accomplish the following:

- Conduct site survey work and develop construction drawings and specifications for the construction of a mid-block crossing with pedestrian refuge on Beach Channel Drive, west of Cranston Avenue, or on the roadway alignment deemed feasible by the NYCDOT.

Estimated Cost:

| | | |
|---|---|---|
| (a) | Site survey and design work: | $30K-$45K |
| (b) | Construction of mid-block crossing: | $90K[35] |
| | Total: | $120K-$135K |

[33] U.S. DOT, Highway Research Center, Pedestrian and Bicycle Information Center. http://www.walkinginfo.org/engineering/roadway-bicycle.cfm. Accessed May 27, 2010.
[34] Michael Sallaberry, PE, Associate Transportation Engineer, San Francisco Department of Parking and Traffic, Shared Lane Markings. http://www.bicyclinginfo.org/bikesafe/case_studies/casestudy.cfm?CS_NUM=711.
[35] Florida State DOT, ftp://ftp.dot.state.fl.us/LTS/CO/Estimates/CPM/summary.pdf. Accessed May 27, 2010.

## Appendix D: Bicycle lane/multi-use trail cost estimates

The cost of installing a bicycle lane depends on several factors, including:

- pavement condition;
- need to remove and repaint lane lines; and
- signalization adjustment.

Bicycle lane insertion is most efficient during street reconstruction, street resurfacing, or at the time of original construction. The estimated cost to install a bicycle lane is approximately $5,000 to $50,000 per mile[36].

The cost of construction for a multi-use trail also varies based on the following factors:

- trail surface;
- width;
- location;
- needed structures;
- signage; and
- other amenities.

Table D-1 provides a general estimate of per-mile costs for trails around the country. These costs assume no major issues related to alignment or clearance problems, water crossings, elevated crossings, or drainage. They also do not account for pavement markings, signage, or lighting. In addition to construction costs, annual maintenance costs range from $1,000 to $2,000 per year, per mile.

**Table D-1 – Per-mile trail cost estimates[37]**

| Trail feature | Cost range per mile |
|---|---|
| 12-foot multi-use: concrete | $279,800 to $406,500 |
| 6 –foot multi-use: concrete | $140,000 to $200,000 |
| 12-foot multi-use: macadam | $138,000 to $228,000 |
| 6 –foot multi-use: macadam | $69,000 to $114,000 |
| 12-foot multi-use: cinder | $59,000 to $111,000 |
| 6-foot multi-use: cinder | $30,000 to $56,000 |
| 10- foot multi-use: asphalt | $150,000 to $175,000 |

[36] Pedestrian and Bicycle Information Center. http://www.walkinginfo.org/engineering/roadway-bicycle.cfm. Accessed June 1, 2010.
[37] American Trails, http://www.americantrails.org/resources/ManageMaintain/MilwMaintcost.htm and Montgomery County, PA Estimates for Constructing Trail Surfaces (2005).

## Appendix E: Bicycle facility types

This appendix provides general descriptions of bicycle facilities and includes example images to illustrate typical facility design and the associated signage requirements based on the Manual on Uniform Traffic Control Devices (MUTCD).

**Class I bicycle paths** – dedicated, exclusive bicycle paths meant for bicycle traffic (see Figure E-1).

**Figure E-1**
**Class I bicycle paths**
Source: Curtis Memorial Library, Maine

**Class II bicycle lanes** - parts of the roadway designated with striping, signing and pavement marking for the preferential or exclusive use by bicyclists (see Figure E-2).

**Figure E-2**
**Class II bicycle lanes**
Source: U.S. DOT Volpe Center


**Class III signed bicycle routes** – signed roadway routes with no roadway markings (see Figure E-3).

**Figure E-3**
**Class III signed bicycle routes**
Source: Healthy Transportation Network

[38]


**Shared roadway** pavement **markings or "sharrows" -** used to indicate a shared lane situation for bicycles and automobiles (see Figure E-4).

**Figure E-4**
**Shared lane markings or "sharrows"**
Source: NACTO


[39]

[38] California Active Communities. http://www.healthytransportation.net/images/small/class3_bikeway.jpg. Accessed May 27, 2010.
[39] National Association of City Transportation Officials, http://www.nacto.org/bikeprefstreets.html. Accessed May 13, 2010.

**Cycle tracks** - bicycle facilities that provide physical separation from motorized vehicle traffic within the roadway, creating an exclusive space for bicyclists. Cycle tracks may include bicycle-only signal phases at intersections or have "mixing zones" that allow bicycle and motor vehicle traffic to merge, generally at intersections. (see Figure E-5).

**Figure E-5**
**Cycle tracks**
Source: Alta Planning and Design

**Bicycle priority streets/bicycle boulevards** - low speed, low volume local streets designed to better accommodate bicycle travel through treatments such as traffic calming and traffic reduction, signage, pavement markings and intersection crossing treatments (see Figure E-6).

**Figure E-6**
**Bicycle boulevards**
Source: NACTO

[40]

[40] *Ibid.*

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Based on both a field site reconnaissance and workshop, this study developed a conceptual plan for the location and design of bicycle facilities to complete a 'missing link' of the Jamaica Bay Greenway through the Rockaway region of Brooklyn and Queens in New York City. Both near-term and long-term interventions were developed. The study focused on non-motorized infrastructure (including signage and wayfinding) to enhance connections for visitors between Jacob Riis Park and the Jamaica Bay Wildlife Refuge - subunits of the Jamaica Bay Unit of the National Park Service Gateway National Recreation Area, as well as connections between these sites and the local subway stations. A sequence of "next steps' has been articulated that the National Park Service could undertake independently, and in partnership with NYC Agencies and public stakeholders.

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